I 19.165:2001/V.3/AFRICA

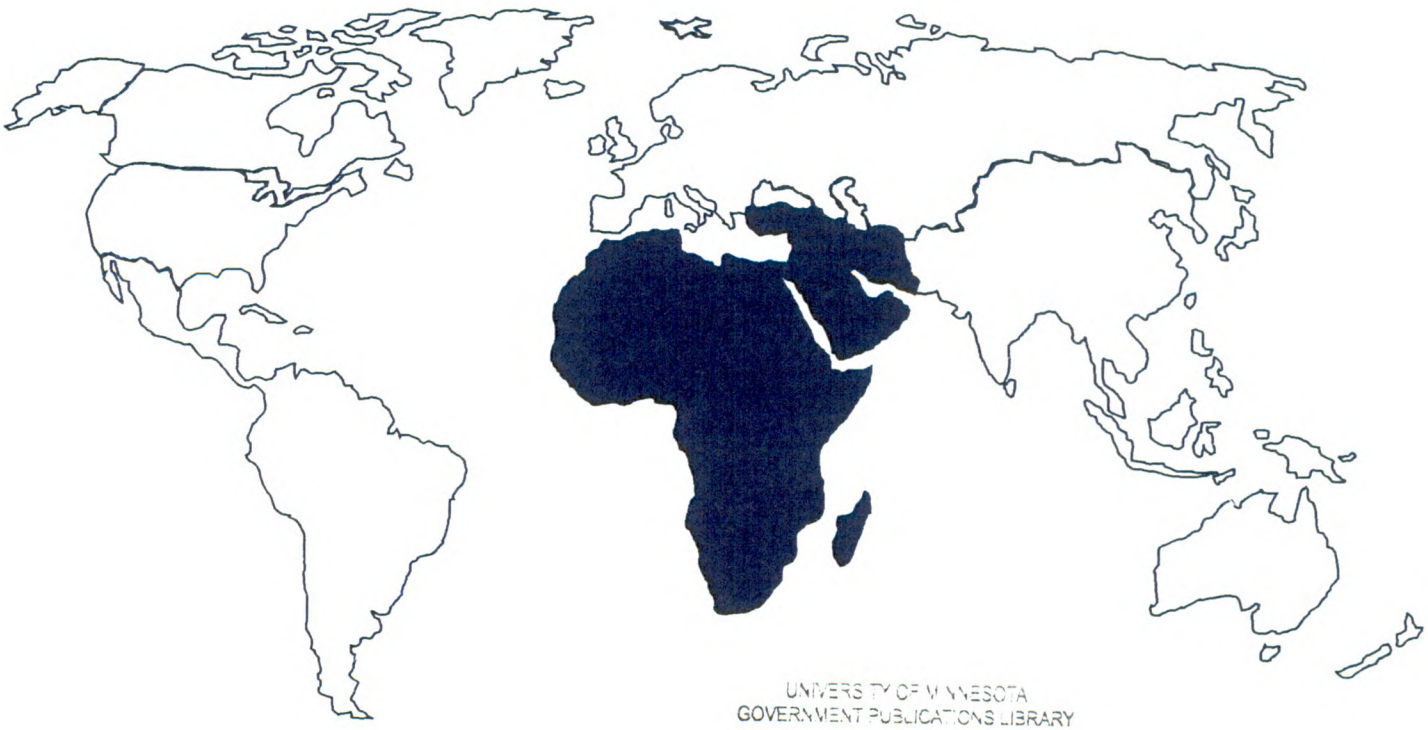
U.S. Department of the Interior
U.S. Geological Survey

MINERALS YEARBOOK

Area Reports: International 2001

Africa and the Middle East

Volume III



UNIVERSITY OF MINNESOTA
GOVERNMENT PUBLICATIONS LIBRARY

MAR 0 1 2004

U.S. DEPOSITORY PROPERTY
U.S.G.P.O.D-295

USGS
science for a changing world

Digitized by Google

U.S. Department of the Interior
U.S. Geological Survey

MINERALS YEARBOOK

Area Reports: International 2001

Africa and the Middle East

Volume III

Digitized by Google

U.S. DEPARTMENT OF THE INTERIOR
GALE A. NORTON, Secretary

U.S. GEOLOGICAL SURVEY
CHARLES G. GROAT, Director

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON: 2003

Published in the Eastern Region, Reston, Va.
Manuscript approved for publication December 16, 2003.

Any use of trade, product, or firm names in this publication is for descriptive purposes only
and does not imply endorsement by the U.S. Government.

For sale by U.S. Government Printing Office
Washington, DC 20402

Digitized by Google

Foreword

This edition of the U.S. Geological Survey (USGS) Minerals Yearbook discusses the performance of the worldwide minerals and materials industries during 2001 and provides background information to assist in interpreting that performance. Content of the individual Minerals Yearbook volumes follows:

- Volume I, Metals and Minerals, contains chapters about virtually all metallic and industrial mineral commodities important to the U.S. economy. Chapters on survey methods, summary statistics for domestic nonfuel minerals, and trends in mining and quarrying in the metals and industrial mineral industries in the United States are also included.
- Volume II, Area Reports: Domestic, contains a chapter on the mineral industry of each of the 50 States and Puerto Rico and the Administered Islands. This volume also has chapters on survey methods and summary statistics of domestic nonfuel minerals.
- Volume III, Area Reports: International, is published as four separate reports. These regional reports contain the latest available minerals data on more than 190 foreign countries and discuss the importance of minerals to the economies of these nations and the United States. Each report begins with an overview of the region's mineral industries during the year. It continues with individual country chapters that examine the mining, refining, processing, and use of minerals in each country of the region and how each country's mineral industry relates to U.S. industry. Most chapters include production tables and industry structure tables, information about Government policies and programs that affect the country's mineral industry, and an outlook section.

The USGS continually strives to improve the value of its publications to users. Constructive comments and suggestions by readers of the Minerals Yearbook are welcomed.

Charles G. Groat, Director

Digitized by Google

Contacts

Information about the U.S. Geological Survey, its programs, staff, and products may be accessed on the World Wide Web at URL http://www.usgs.gov or by contacting the Earth Science Information Center at 1-888-ASK-USGS. For specific information about this publication, contact the Chief, International Minerals Section, Minerals Information Team, at (703) 648-7732, or the Chief, Publication Services Section, Minerals Information Team, at (703) 648-7790. Additional minerals information may be accessed on the World Wide Web at URL http://minerals.usgs.gov/minerals.

Digitized by Google

Acknowledgments

The Country Specialists in the Minerals Information Team, U.S. Geological Survey, in preparing the International Review regional books of volume III of the Minerals Yearbook, extensively use statistics and data on mineral production, consumption, and trade provided by various foreign Government minerals and statistical agencies through various official publications. The cooperation and assistance of these organizations are gratefully acknowledged. Statistical and informational material was also obtained from reports of the U.S. Department of State, United Nations publications, and the domestic and foreign technical and trade press. Of particular assistance were reports submitted by the Resource Reporting Officers and other officers of the Department of State in U.S. Embassies worldwide. Their contributions are sincerely appreciated. Internal statistical support was provided by the staff of the Data Collection and Coordination Section of the Minerals Information Team.

The regimes of some countries reviewed in this volume may not be recognized by the U.S. Government. The information contained herein is technical and statistical in nature and is not to be construed as conflicting with or being contradictory of U.S. foreign policy.

John H. DeYoung, Jr.
Chief Scientist, Minerals Information Team

Digitized by Google

Contents

Foreword, by Charles G. Groat iii
Contacts iv
Acknowledgments, by John H. DeYoung, Jr. v
Africa, by George J. Coakley, Philip M. Mobbs, Philip A. Szczesniak, David R. Wilburn, and Thomas R. Yager 1.1
Algeria, by Philip M. Mobbs 2.1
Angola, by George J. Coakley 3.1
Benin, Cameroon, Cape Verde, the Central African Republic, Gabon, Sao Tomé e Príncipe, and Togo, by Philip A. Szczesniak 4.1
Botswana, by George J. Coakley 5.1
Burkina Faso, Mali, Mauritania, and Niger, by Philip A. Szczesniak 6.1
Burundi, Comoros, Malawi, Mauritius, Reunion, Rwanda, and Seychelles, by Thomas R. Yager 7.1
Chad, by Philip M. Mobbs 8.1
Congo (Brazzaville), by George J. Coakley 9.1
Congo (Kinshasa), by George J. Coakley 10.1
Côte d'Ivoire, Guinea, Liberia, and Sierra Leone, by Philip A. Szczesniak 11.1
Djibouti, Eritrea, Ethiopia, and Somalia, by Thomas R. Yager 12.1
Egypt, by Philip M. Mobbs 13.1
Equatorial Guinea, by Philip M. Mobbs 14.1
Gambia, The, Guinea-Bissau, and Senegal, by Philip A. Szczesniak 15.1
Ghana, by George J. Coakley 16.1
Kenya and Uganda, by Thomas R. Yager 17.1
Lesotho, by George J. Coakley 18.1
Libya, by Philip M. Mobbs 19.1
Madagascar, by Thomas R. Yager 20.1
Morocco and Western Sahara, by Philip A. Szczesniak 21.1
Mozambique, by Thomas R. Yager 22.1
Namibia, by George J. Coakley 23.1
Nigeria, by Philip M. Mobbs 24.1
South Africa, by George J. Coakley 25.1
Sudan, by Thomas R. Yager 26.1
Swaziland, by George J. Coakley 27.1
Tanzania, by Thomas R. Yager 28.1
Tunisia, by Philip M. Mobbs 29.1
Zambia, by George J. Coakley 30.1
Zimbabwe, by George J. Coakley 31.1
The Middle East, by Philip M. Mobbs, David R. Wilburn, and Thomas R. Yager 32.1
Bahrain, Kuwait, Oman, Qatar, United Arab Emirates, and Yemen, by Philip M. Mobbs 33.1
Cyprus, by Philip M. Mobbs 34.1
Iran, by Philip M. Mobbs 35.1
Iraq, by Philip M. Mobbs 36.1
Israel, by Thomas R. Yager 37.1
Jordan, Lebanon, and Syria, by Thomas R. Yager 38.1
Saudi Arabia, by Philip M. Mobbs 39.1
Turkey, by Philip M. Mobbs 40.1

Digitized by Google

THE MINERAL INDUSTRIES OF

AFRICA

By George J. Coakley, Philip M. Mobbs, Philip A. Szczesniak, David R. Wilburn, and Thomas R. Yager

The 55 independent nations and other territories of continental Africa and adjacent islands covered in this volume encompass a land area of 30.3 million square kilometers, which is more than three times the size of the United States, and were home to 808 million people in 2001. For many of these countries, mineral exploration and production constitute significant parts of their economies and remain keys to future economic growth. Africa is richly endowed with mineral reserves and ranks first or second in quantity of world reserves of bauxite, chromite, cobalt, diamond, gold, manganese, phosphate rock, platinum-group metals (PGM), titanium minerals (rutile and ilmenite), vanadium, vermiculite, and zirconium.

The minerals industry was an important source of export earnings for many African nations in 2001. To promote exports, groups of African countries formed numerous trade blocs, which included the Economic and Monetary Community of Central Africa, the Economic Community of the Great Lakes Countries, the Common Market for Eastern and Southern Africa; the Economic Community of Central African States, the Economic Community of West African States, the Mano River Union, the Southern African Development Community, and the West African Economic and Monetary Union. Algeria, Libya, and Nigeria were members of the Organization of the Petroleum Exporting Countries (OPEC).

In 2001, significant events in the minerals industry of Africa included the opening of new gold mines in Mali and Tanzania; high rates of economic growth in Equatorial Guinea and Mozambique attributable to increasing mineral production; the United Nations (U.N.) report on the alleged illegal exploitation of mineral resources in Congo (Kinshasa) by Namibia, Rwanda, Uganda, and Zimbabwe; the Kimberly process agreement on diamond certification; and World Bank approval of funding for energy projects in Tanzania and Uganda.

The U.S. Geological Survey (USGS) would like to thank the following Government agencies, international institutions, and private research organizations for providing minerals production statistics, basic economic data, and mineral exploration and other mineral-related information:

- For mineral production statistics—
  - Angola—Ministry of Petroleum,
  - Benin—Ministry of Mines, Energy, and Water Resources,
  - Botswana—Director of Mines,
  - Burundi—Ministry of Energy and Mines,
  - Cameroon—Ministry of Mines, Water, and Energy,
  - Congo (Brazzaville)—National Center of Statistics and Economic Studies,
  - Egypt—Central Agency for Public Mobilization and Statistics,
  - Gambia, the—Department of State for Trade Industry and Employment,
  - Lesotho—Ministry of Natural Resources and Department of Mines and Geology,
  - Madagascar—Ministry of Energy and Mines,
  - Malawi—Geological Survey Department,
  - Morocco—Ministry of Industry, Trade, Energy, and Mines,
  - Namibia—Ministry of Mines and Energy,
  - Nigeria—Ministry of Solid Minerals Development,
  - Rwanda—Ministry of Energy, Water, and Natural Resources,
  - Seychelles—Ministry of Industries and International Business,
  - South Africa—Department of Minerals and Energy,
  - Tanzania—Ministry of Energy and Minerals, and
  - Uganda—Geological Survey and Mines Department.
- For basic economic data—the International Monetary Fund in the United States.
- For minerals consumption data—
  - British Petroleum plc,
  - MEPS (International) Ltd., and
  - United Nations Food and Agricultural Organization,
  - U.S. Department of Energy,
  - World Bureau of Metal Statistics.
- For exploration and other mineral related information—the Metals Economics Group in Canada.

General Economic Conditions

In 2001, the gross domestic product (GDP) of Africa grew by 3% after increasing by 2.8% in 2000. From 1996 to 2001, Africa's GDP grew at an average rate of about 3.2% per year (International Monetary Fund, 2002, p. 49, 174). In 2001, Equatorial Guinea and Mozambique achieved the most rapid economic growth in Africa with GDP increases of 45.5% and 13.9%, respectively. The expansion of the petroleum and natural gas industries was a major factor in the performance of Equatorial Guinea's economy. In Mozambique, increased output from the Mozal SARL aluminum smelter made a substantial contribution to GDP growth. In 2002, Africa's GDP growth was expected to be constrained by low coffee and cotton prices, drought, and falling agricultural output. In 2003, growth was expected to increase because of higher prices for coffee, cotton, and metals and a recovery in the world economy.

Digitized by Google

The International Monetary Fund (2002, p. 174-175, 232) predicted that Africa's GDP would increase by 3.1% in 2002, 4.2% in 2003, and 4.8% per year from 2004 to 2007. In South Africa, GDP growth was expected to be 2.5% in 2002 and 3.0% in 2003; expected higher gold prices would likely boost economic growth. The economy of Egypt was expected to grow by 2% in 2002 and 3.7% in 2003. In Morocco, the economy was predicted to grow by 4.4% in 2002 and 4.1% in 2003. Algeria's GDP growth was expected to slow to 2.1% in 2002 before increasing to 2.9% in 2003. Nigeria's GDP was expected to decrease by 2.3% in 2002 and to increase by 3.7% in 2003; cutbacks in oil production owing to OPEC quotas were likely to have a serious effect upon the economic situation in Algeria and Nigeria.

In general, GDP growth in African oil exporting countries was expected to fall to 2.2% in 2002 and to rise to 3.4% in 2003. In oil importing countries, GDP growth was expected to be 3.3% in 2002 and 4.4% in 2003. Improvements in the economic outlook depended upon increasing political stability and the absence of natural disasters (International Monetary Fund, 2002, p. 49, 51, 54, 232).

Investment Interest and Political Risk

A recent review of company investment plans for the period from 2000 to 2007 indicated the potential for the region to attract substantial oil and gas development, primarily in Angola and Nigeria. Investment in mining and mineral processing projects was likely to be concentrated in Mozambique (aluminum and titanium minerals), South Africa (gold, PGM, and titanium), Tanzania (gold), and Zambia (copper).

In 2001, the Government of Madagascar announced that power generation would be opened to the private sector, although transmission and distribution would remain under state control. The International Monetary Fund and the World Bank announced plans to assist Madagascar in reforming its mining sector. Programs would include supervision of the artisanal mining sector, assistance to gemstone cutting and polishing centers, and updated geological data. The National Assembly passed legislation to cut import duties, corporate income taxes, and property taxes in support of attracting large-scale mining projects.

In March, the Uganda Electricity Board was divided into three successor companies; the functions of generation, transmission, and distribution were separated. The Government started to seek bidders for the privatization of generation and distribution in June. The Government also planned to privatize the Karuruma Tin Works.

Countries directly affected by civil wars, internal ethnic or political conflicts, and refugee displacements in 2001 included Algeria, Angola, Burundi, Central African Republic, Chad, Congo (Kinshasa), Ethiopia, Guinea, Guinea-Bissau, Liberia, Rwanda, Sierra Leone, Somalia, Sudan, and Uganda. Angola, Namibia, Rwanda, Uganda, and Zimbabwe were affected by the burden of providing military assistance in the civil war in Congo (Kinshasa).

The United Nations Security Council issued a report that accused Namibian, Rwandan, Ugandan, and Zimbabwean Government officials, military officers, and businessmen of illegally exploiting columbium (niobium), diamond, gold, and tantalum from Congo (Kinshasa) to enrich themselves and to finance their country's military presence in Congo (Kinshasa). The Governments accused denied the accusations. Rebels and pro-Government militias that operated in Congo (Kinshasa) were also accused of using their military presence to exploit Congolese mineral resources.

Exploration

Exploration activity as defined by reported company exploration budgets for Africa continued to decline during 2001. In its most recent annual review, a consulting group reported a modest drop in exploration spending allocations for Africa of about 6 % from the 2000 level (Metals Economics Group, 2001§). In terms of worldwide allocation, however, the group reported that of Africa actually increased to 13.8% in 2001 compared with the reported 12.5% in 2000.

In 2001, exploration in some parts of Africa increased as the threat of civil strife eased. In other African countries, civil wars, internal ethnic or political conflicts, and refugee displacements continued to destabilize governments and constrained new investment in mineral exploration in many areas. Some international mining companies have expressed reluctance to invest heavily in some areas of Africa because of the perceived long-term instability, increased incidence of HIV/AIDS, and a poor record of recent successful base-metal development (Hinde, 2001).

Recent low mineral commodity prices and industry consolidation and restructuring have increased competition among African, Australian, and North American companies that search for more-advanced projects on the continent. Following a period of corporate restructuring in South Africa, such companies as AngloGold Inc., Ashanti Goldfields Company Ltd. of Ghana, Gold Fields Ltd., and Randgold Resources Ltd. were aggressively competing with foreign companies to expand their exploration and acquisition activities into other parts of Africa. These companies were targeting junior exploration companies that had successfully located drill-identified gold resources during the peak exploration years from 1996 to 1999 during which nearly $2 billion was spent on African mineral exploration.

Based on site data collected by the USGS, African countries that experienced the highest levels of exploration activity in 2001 were, in descending order by number of sites explored, South Africa, Tanzania, Mali, Ghana, Burkina Faso, and Namibia. Gold accounted for approximately 53% of the reported African exploration projects; diamond, 20%; PGM, about 12%; and base metals, about 11%. Exploration for gold was concentrated in the sub-Saharan African countries of Burkina Faso, Ghana, Mali, and Tanzania. Several diamond and PGM projects in South Africa and gold projects in Tanzania were reported to have reached the advanced development or early production stages.

Digitized by Google

the southern countries of Botswana, Namibia, and South Africa and in the northwestern countries of Guinea and Sierra Leone. Offshore diamond exploration in Namibia continued to stimulate a mining sector that had declined in recent years. Higher prices for PGM early in 2001 stimulated the search for these minerals, and several major new PGM development projects and the proposed expansion of existing PGM operations were announced.

For several years, some of Africa's mineral riches (diamond, gold, and, more recently, tantalum) have reportedly been used to finance civil wars and border conflicts that have destabilized a number of central African countries. This has significantly increased political risks and constrained investment in mineral exploration and development in the region. Revenues from "conflict" diamond have supported civil strife in Angola and Sierra Leone and were valued at $255 million in 1999, or about 4% of the world diamond market (Goreux, 2001). In 2001, after more than a year of talks, Government and industry negotiators from dozens of countries agreed on a framework for a system to certify legitimately traded diamonds. The plan has since gone to the U.N. General Assembly for its endorsement.

Commodity Review

The commodity outlook segments listed below are based upon projected trends that could affect current producing facilities and planned new facility capacities that the operating companies, consortia, or Governments have projected to come online within the indicated timeframes. Projects that have received approval from a company's board of directors would be typical of projects considered to have a chance of proceeding within the indicated timeframes. Forward-looking information, which includes estimates of future production, exploration, and mine development; cost of capital projects; and timing of commencement could differ materially from actual results. As such, projects listed in the following section are presented as an indication of current industry plans and are not a USGS prediction of what will happen. The USGS provides no warranty, expressed or implied, as to the accuracy, reliability, or completeness of furnished data and is under no obligation to correct or update any forward-looking statements, whether as a result of new information, future events, or otherwise.

Metals

Aluminum.—*Production.*—In 2001, African production of primary refined aluminum was nearly 1.36 million metric tons (Mt); this was an increase of 18.3% from 2000. The increase in production was mostly attributable to higher output at the Mozal smelter in Mozambique, which was in its first full year of operation. Output increased by 14.1% in Ghana and fell by 1.8% in South Africa. Production fell in Cameroon and Egypt by 5.8% and 2.1%, respectively. Africa's share of world primary aluminum production increased to 5% in 2001 from 3% in 1995. South Africa accounted for 49% of African aluminum output; Mozambique, 20%; and Egypt, 14% (tables 1, 30).

African bauxite production rose to 16.4 Mt in 2001 from 16.2 Mt in 2000. In Ghana, investment and equipment upgrades led to higher bauxite production. Guinea accounted for 96% of bauxite production, and Ghana, 4%. From 1995 to 2001, Africa's share of world bauxite production fell to 12% from 15% (tables 2, 30). Guinea was the only African producer of alumina; output remained nearly unchanged in 2001. Guinea accounted for about 1% of world alumina production.

Consumption.—Africa's share of the world's primary aluminum consumption in 2001 was nearly 2%. Continental consumption reportedly rose to 361,400 metric tons (t) of primary aluminum in 2001 from 335,800 t in 2000 and 241,900 t in 1996. South Africa accounted for 55% of African primary aluminum consumption; Egypt, 27%; and Cameroon, 7%. In 1996, South Africa's share of continental primary aluminum consumption was 42% (World Bureau of Metal Statistics, 2000, p. 9; 2002, p. 9).

Outlook.—After remaining unchanged in 2002, the outlook for African production of primary refined aluminum is an increase of 5.9% in 2003 and an increase of 36.8% by 2005. In South Africa, expansion of the Hillside Smelter would likely add 150,000 metric tons per year (t/yr) of new production in 2005 and 2007. Aluminum Smelter Co. of Nigeria Ltd. is expected to reopen its smelter at Ikot Abasi by 2005. In Mozambique, the expansion of the Mozal smelter is likely to be completed in late 2003. By 2007, Mozambique, which was not a producer of refined aluminum before 2000, is expected to account for 25% of African primary refined aluminum production. The outlook for African bauxite production is an increase to 17 Mt in 2005 from 16.8 Mt in 2003 and 16.5 Mt in 2002 (tables 1, 2).

For the first 9 months of 2002, African consumption of primary aluminum was about 2% lower than the same period in 2001. The decrease was mostly because of falling demand in Egypt (World Bureau of Metal Statistics, 2002, p. 9).

Copper.—*Production.*—In 2001, Africa's mine production amounted to 533,000 t, which was an increase of 20.3% from 2000. Zambia was the largest producer of copper ore in Africa; most of the increase in African output was attributable to the 25.3% rise in Zambian production. Zambian production rose at the Konkola, Mufalira, and Nkana Mines; South African output, by nearly 4%; and production also increased in Namibia. In 2001, Zambia accounted for 58% of African copper mine production; South Africa, 27%; and Namibia, 5%. Continental copper mine production was down sharply from its 1990 level; Africa's share of world copper production fell to 4% in 2001 from 14% in 1990 (tables 3, 30).

Africa's refined copper production increased by 17.2% in 2001. Zambian output increased by 30.4%, and South African output, by 4.8%. In 2001, Zambia accounted for 65% of African refined copper production; South Africa, 29%; and Congo (Kinshasa), 5% (table 4). Africa accounted for 3% of world refined copper output.

Consumption.—African consumption of copper rose to 142,100 t in 2001 compared with 131,600 t in 2000 and 112,100 t in 1996. In 2001, Africa's share of the world's copper consumption was 1%. South Africa, which was the

Digitized by Google

dominant consumer of base metals in Africa, accounted for 52% of regional copper consumption; Egypt, 24%; Zambia, 11%; and Zimbabwe, 8%. In 1996, South Africa's and Egypt's shares of regional copper consumption were 68% and 4%, respectively (World Bureau of Metal Statistics, 2000, p. 41; 2002, p. 41).

Outlook.—African copper mine production is expected to rise by 6.2% in 2002, 6.9% in 2003, and an average of 7.2% per year from 2004 to 2007. South African production is likely to decrease to 113,000 t. Output is expected to increase to about 500,000 t in Zambia because of the start of the Chambishi Mine and increased production from the Mufalira and Nkana Mines. By 2007, copper mine production in Congo (Kinshasa) is likely to have reached 130,000 t; this increase would be partially attributable to the startup of the Lonshi Mine in 2003. Ore from the Lonshi Mine is also expected to contribute to higher output of refined copper in Zambia. Africa's production of refined copper is likely to increase by 7.2% in 2002, 5.5% in 2003, and 9.8% per year from 2004 to 2007 (tables 3, 4).

For the first 9 months of 2002, African consumption of refined copper was 15.8% higher than that of the same period in 2001. Most of the increase was attributable to higher demand in South Africa (World Bureau of Metal Statistics, 2002, p. 41).

Gold.—*Production.*—Africa's gold mine production was 594,000 kilograms (kg) in 2001, which was a decrease of nearly 2.3% from 2000 and 7.8% from 1995. From 1995 to 2001, Africa's share of world gold mine production fell to 23% from 29% (tables 5, 30). In South Africa, lower output from Anglogold Ltd. and Harmony Gold Mining Co. Ltd. caused national gold production to fall by 8.4% in 2001. Output fell in Zimbabwe and Ghana by 18.2% and 4.7%, respectively. These declines in production more than offset sharp increases in production in Mali and Tanzania. Mali's output increased to 42,288 kg from 28,717 kg because of the opening of the Morila Mine. Tanzania's gold production rose to 30,088 kg from 15,060 kg because of the opening of the Bulyanhulu Mine and increased output at the Geita Mine. South Africa accounted for 66% of African gold production; Ghana, 12%; Mali, 7%; and Tanzania, 5%. South Africa's share of continental gold production (66%) fell from 81% in 1995 and 89% in 1990 (table 5).

Outlook.—Gold mine production is expected to rise by 1.5% in 2002, 10% in 2003, and 1.8% per year from 2004 to 2007. South African output is likely to rise to 395 t in 2002, 451 t in 2003, 454 t in 2005, and 478 t in 2007. The increase in production would be partially attributable to the opening of the Moab Khotsong, South Deep, and Target Mines. Ghana's gold production is expected to fluctuate between 2001 and 2005 before rising to nearly 76 t in 2007. By 2007, gold production in Mali, Tanzania, and Guinea is expected to reach 55 t, 52 t, and 19 t, respectively (table 5). Output in Tanzania is likely to rise with the opening of the North Mara and Tulawaka Mines and the increased capacity at the Bulyanhulu, Geita, and Golden Pride Mines. In Guinea, the opening of the Jean Gobele Mine is expected to contribute to higher production.

Iron and Steel.—*Production.*—In 2001, the production of iron ore amounted to 49.63 Mt, which was a decrease of less than 1% from that of 2000. The iron content amounted to 32 Mt. In South Africa, production rose by 3.1% because of higher output at the Sishen Mine. Production fell in Algeria, Mauritania, and Zimbabwe. South Africa was the largest iron ore producer in Africa; its share of continental output amounted to 70%. Mauritania and Egypt accounted for 23% and 4% of African production, respectively. Africa produced about 5% of the world's iron ore (tables 6, 30).

In 2001, African production of crude steel increased by 8%. Egypt, which was the second largest African producer, accounted for most of the increase in output; the country's production rose by 34.8%. South Africa's output rose by 4% in 2001. Production rose in Algeria, Libya, and Tunisia and fell in Zimbabwe. South Africa accounted for 59% of regional crude steel production; Egypt, 26%; Libya, 6%; and Algeria, 6%. Africa's share of world crude steel production was about 2% in 2001 (tables 7, 30).

Algeria's production of hot-rolled steel products amounted to nearly 1.05 Mt in 2001, which was an increase from 687,000 t in 2000 and 521,000 t in 1996. South Africa produced about 6.4 Mt of hot-rolled steel products compared with 6.11 Mt in 2000 and 6.56 Mt in 1996. In 2000, South Africa accounted for 48% of continental hot-rolled steel production; Egypt, 31%; and Libya, 9% (International Iron and Steel Institute Committee on Economic Studies, 2002, p. 52).

Consumption.—Africa accounted for 2% of global finished steel consumption. Africa consumed 17.97 Mt of finished steel products in 2001, which was an increase from 15 Mt in 2000 and 13.5 Mt in 1996. From 1996 to 2001, South Africa's consumption of steel products rose to 4.21 Mt from 4.01 Mt. Egypt's consumption increased to 4.36 Mt from 3.94 Mt; Algeria's consumption increased to 2.5 Mt from 1.41 Mt; and the demand for steel by other African countries rose to 6.9 Mt from 4.14 Mt (International Iron and Steel Institute Committee on Economic Studies, 2002, p. 91-92).

Outlook.—The production of iron ore is likely to increase to 51.5 Mt in 2002, 51.1 Mt in 2003, and 53.3 Mt in 2005 and 2007. Iron content would rise to 33 Mt in 2005 and 2007. Most of the increase would be attributable to South Africa where the expansion of the Sishen Mine is expected to boost output.

Crude steel production is likely to increase by 2.7% in 2002, to remain unchanged in 2003, and to rise by 1.9% per year from 2004 to 2007. The increase is expected to be broadly based with output rising in Algeria, Egypt, Libya, South Africa, and other producing countries. Libya is likely to have the largest increase of the major producers; output is expected to rise by nearly 54% from 2001 to 2007.

Regional consumption of finished steel is expected to increase by 2% in 2002 and between 1% and 2% from 2003 to 2006. During this period, Africa's share of world steel consumption is unlikely to change (MEPS (International) Ltd., 2002§).

Lead.—*Production.*—Africa accounted for about 5% of world lead mine production. In 2001, continental lead mine production fell by 15.4% from 2000 and 17.8% from 1995. Output fell in Morocco and South Africa, which were the two largest producers of lead ore in Africa, and increased in Algeria,

Digitized by Google

Namibia, and Tunisia. In South Africa, national production fell because of lower output at the Black Mountain Mine. Morocco accounted for 52% of African lead mine production; South Africa, 34%; and Namibia, 9% (tables 8, 30).

In 2001, African production of primary refined lead fell by 11.9%; most of the decrease was attributable to Morocco where output fell by 12.9%. Morocco, which was the largest African producer of primary refined lead, accounted for 91% of continental output; Algeria's share was 9% (table 9). Africa accounted for 2% of world primary lead production.

South Africa accounted for 92% of African secondary refined lead output; in 2001, African production of secondary refined lead increased by 5.6% because of higher South African production. Output in Kenya and Morocco remained unchanged. The share of primary lead in total refined lead production in Africa fell to 55% in 2001 from 66% in 1995 and 72% in 1990 (tables 9, 10).

Consumption.—In 2001, continental refined lead consumption fell to 106,600 t from 114,600 t in 2000 and 114,100 t in 1996. Africa's share of the world's lead consumption was nearly 2%. South Africa accounted for 51% of regional lead consumption; Algeria, 20%; and Morocco, 8% (World Bureau of Metal Statistics, 2000, p. 82; 2002, p. 82).

Outlook.—Africa's lead mine production is expected to increase by 2.7% in 2002, 17.8% in 2003, and 3.1% per year from 2004 to 2007. By 2005, output in South Africa and Morocco was likely to rise by 65% and 17%, respectively. In South Africa, the expansion of the Black Mountain Mine would account for most of the higher output. The production of primary refined lead is expected to increase slightly to 66,000 t in 2003 and to remain stable through 2007. Secondary refined lead production is expected to rise by 2.1% in 2002 (tables 8-10).

The decline in African consumption of refined lead is likely to reverse because of higher demand in South Africa. In the first 9 months of 2002, South Africa's consumption of refined lead was 27.1% more than that of the same period in 2001. During the same period, regional consumption of refined lead increased by 7.1% (World Bureau of Metal Statistics, 2002, p. 82).

Nickel.—*Production.*—In 2001, Africa produced about 5% of the world's nickel mine output. African mine production of nickel was unchanged compared with that of 2000. The modernization and expansion of the Trojan Mine in Zimbabwe offset falling production in Botswana and South Africa. In 2001, South Africa accounted for 56% of African nickel mine output; Botswana, 29%; and Zimbabwe, 15% (table 11).

Consumption.—Demand for refined nickel fell to 34,500 t in 2001 from 38,000 t in 2000 and increased from 24,800 t in 1996. Africa accounted for 3% of the world's nickel consumption. Within the region, South Africa, which was the dominant consumer, accounted for nearly 99% of African nickel demand (World Bureau of Metal Statistics, 2000, p. 105; 2002, p. 105).

Outlook.—African mine production of nickel is expected to rise by 4.1% in 2002, 4% in 2003, and by 9.1% per year from 2004 to 2007. Increased capacity at the Nkomati Mine is likely to raise South Africa's share of continental nickel mine production to 61% by 2007. Production is also expected to increase in Botswana and Zimbabwe (table 11). For the first 9 months of 2002, Africa's consumption of refined nickel was up by 7.5% compared with the same period in 2001 (World Bureau of Metal Statistics, 2002, p. 105).

Platinum-Group Metals.—*Production.*—In 2001, Africa's production of platinum, palladium, and rhodium increased by 13.3%, 5.6%, and 11.5%, respectively. South Africa, which was the continent's dominant producer of PGM in Africa, accounted for more than 99% of the production of platinum, palladium, and rhodium. Africa's share of world platinum mine output was 72% and palladium, 36% (tables 12, 13).

Outlook.—African production of platinum is expected to increase to rise by 2.9% in 2002, 3.7% in 2003, and 1.1% per year from 2004 to 2007. In 2007, South Africa is likely to produce 140,000 kg of platinum, and Zimbabwe, 5,000 kg. African production of palladium is expected to rise by 2.1% in 2002, by 6.6% in 2003, and 4.1% from 2004 to 2007. In 2007, South Africa is expected to produce 67,200 kg of palladium, and Zimbabwe, 3,600 kg (tables 12, 13). In South Africa, capacity expansions by Anglo American Platinum Corp. Ltd., Impala Platinum Holdings Ltd., Lonmin plc, and other companies are likely to result in higher production. In Zimbabwe, higher output is likely to result from the expansions of the Makwiro and Mimosa Mines.

Silver.—*Production.*—In 2001, African mine production of silver fell by 8.2% compared with that of 2000. Although output fell by 3.1% in Morocco, which was the largest producer of silver in Africa, the 24% decrease in South African production was a substantially larger factor in the decline in continental production. South Africa's output fell because of lower production at gold, lead, and zinc mines. In Namibia, output rose by 36.5%. In Tanzania, the opening of the Bulyanhulu gold mine accounted for most of the increase in output to 6,861 kg from 1,384 kg. Zambian production also increased. Morocco accounted for 66% of continental output; South Africa, 26%; and Namibia, 3%. Africa's share of world silver mine production was about 2% in 2001 (table 14).

Outlook.—Africa's silver mine production is rise by 2.3% in 2002, 1.1% in 2003, and less than 1% per year from 2004 to 2007 (table 14). By 2005, Morocco's production is likely to rise by more than 7% because of higher output at Société Metallurgique d'Imiter's mine near Quarzazate. In Tanzania, production is expected to rise because of the Bulyanhulu Mine. Production is expected to rise in South Africa as gold, lead, and nickel output increases.

Tin.—*Production.*—Africa accounted for less than 1% of global tin mine and refined tin production. In 2001, continental tin mine production fell to 343 t from 511 t in 2000 and 4,051 t in 1990. Since 1990, tin mining has ceased in Namibia, South Africa, and Zimbabwe, which were formerly Africa's largest producers of tin ore (table 15).

In Rwanda, which was Africa's largest producer of tin ore in 2001, output fell by 38% compared with that of 2000. Production also fell in Burundi but increased in Uganda.

Digitized by Google

Nigeria was the only producer of refined tin in Africa; its output has fallen sharply since 1995 (tables 15, 16).

Consumption.—In 2001, continental consumption of refined tin rose to 3,100 t from 2,800 t in 2000 and 2,500 t in 1996. Africa's share of the world's tin consumption was slightly more than 1%. In 2001, South Africa accounted for 65% of the region's tin consumption; Nigeria, 10%; and Egypt, 6% (World Bureau of Metal Statistics, 2000, p. 122; 2002, p. 122).

Outlook.—The Metal Processing Association is expected to produce 200 t/yr of refined tin from its smelter in Rwanda starting in August 2002 (table 16). Africa's share of world tin mine and refined tin production, however, is still likely to remain below 1% until at least 2007. Refined tin consumption is likely rise in 2002 because of higher demand in South Africa. For the first 9 months of 2002, African consumption of refined tin was 82.6% higher than that of the same period in 2001 (World Bureau of Metal Statistics, 2002, p. 122).

Titanium.—*Production.*—The titanium dioxide (TiO_2) content of ilmenite produced in Africa fell to 994,000 t in 2001 from 1.02 Mt in 2000. Output fell by 2.7% in South Africa and remained unchanged in Egypt. South Africa accounted for 93% of regional production, and Egypt, 7% (table 17).

Outlook.—The TiO_2 content of African ilmenite production is expected to rise to 1.12 Mt in 2003, 1.85 Mt in 2005, and 2.05 Mt in 2007. Most of the increase in output would come from the start of the Richards Bay Project in South Africa, the Kwale Project in Kenya, and the Corridor Sands and Moma Projects in Mozambique. By 2007, Mozambique, which was not producing ilmenite in 2001, would account for 34% of African ilmenite production. The reopening of Sierra Rutile in Sierra Leone is expected to boost continental production of ilmenite starting in 2003 (table 17).

Tungsten.—*Production.*—In 2001, African production of tungsten in ore increased to 165 t from 108 t in 2000 and 86 t in 1995. Tungsten production increased in Rwanda and resumed at the Nyamulilo deposit in Uganda (table 18). Africa accounted for less than 1% of global tungsten mine production.

Outlook.—Although Africa's output would more than double by 2007, the continent is likely to remain a minor producer of tungsten through at least 2007 (table 18).

Zinc.—*Production.*—Africa's mine production of zinc fell by 8.3% in 2001. The decline was broadly based with Namibia's output falling by 18.7%; Morocco, 13.3%; Tunisia, 3%; and South Africa, 2.4%. In South Africa, national production fell because of lower output at the Black Mountain Mine. Morocco accounted for 38% of African zinc mine production; South Africa, 26%; Tunisia, 17%; and Namibia, 14%. Africa's share of world zinc mine production was about 3% (tables 19, 30).

South Africa was the largest producer of refined zinc in Africa. In 2001, African production of refined zinc increased by 4.4% because of rising output from South Africa (table 20).

Consumption.—In 2001, Africa's consumption of zinc slab fell to 189,500 t from 201,700 t in 2000 but was still greater than the 147,000 t in 1996. Africa's share of the world's zinc slab consumption was slightly more than 2%. In 2001, South Africa accounted for 63% of regional zinc slab consumption; Egypt, 9%; and Nigeria, 8% (World Bureau of Metal Statistics, 2000, p. 130; 2002, p. 130, 142).

Outlook.—African zinc mine production is likely to remain unchanged in 2002 and to increase by 14% in 2003 and 12.7% per year from 2004 to 2007. Most of the increase would be attributable to the Kipuhsi Mine in Congo (Kinshasa) and the Skorpion Mine and smelter project in Namibia. By 2007, Namibia would account for 42% of African zinc mine production, and Congo (Kinshasa), 12%. In Morocco, which was Africa's largest producer of zinc ore, output is expected to rise by nearly 29% by 2007. In South Africa, which was the continent's second largest producer, output is expected to fall by nearly 43% during the same period to 35,000 t/yr because of the closing of the Perring Mine (table 19).

New smelters in Congo (Kinshasa) and Namibia were likely to increase regional production of refined zinc to 284,000 t in 2003 and 334,000 t in 2007. Namibia, which did not produce refined zinc in 2001, would account for 45% of Africa's refined zinc output in 2007, and Congo (Kinshasa), 15%.

For the first 9 months of 2002, African zinc slab consumption was 1.1% higher than that of the same period in 2001. Consumption in South Africa was 4.6% higher during the same period, which offset lower demand in Tunisia (World Bureau of Metal Statistics, 2002, p. 130).

Industrial Minerals

Diamond.—Production.—In 2001, Africa's share of world diamond production by volume was 56%, compared with 47% in 1995. The continent's diamond production increased to 65.5 million carats in 2001 from 62.2 million carats in 2000 and 55 million carats in 1995. The increase in production was broadly based, with output rising in Angola, Botswana, Congo (Kinshasa), and South Africa. In Botswana, increased production from the Jwaneng, Letlhakane, and Orapa Mines boosted national diamond output by 7.2%. In South Africa, the 3.4% increase in production was mostly attributable to higher output from the Finsch and Venetia Mines. Botswana accounted for 40% of African diamond output by volume; Congo (Kinshasa), 28%; South Africa, 17%; and Angola, 8% (tables 21, 30).

In 2001, the global value of rough diamond production amounted to $7.9 billion, of which Africa accounted for more than 60%. Botswana accounted for nearly 27% of the value of global rough diamond output; South Africa, 15%; Angola, 9%; and Namibia, 6%. In 2001, South Africa, which was Africa's largest producer of polished diamond, produced about $600 million of polished diamond from $500 million of rough diamond. South Africa accounted for about 5% of the global value of polished diamond production (Even-Zohar, 2002).

In November, the Kimberly process established a certification system to reduce the trade of conflict diamonds, particularly from Angola, Congo (Kinshasa), and Sierra Leone. The Kimberly process involved Government officials from nearly 40 countries that produced, processed, and imported diamonds; the World Diamond Council; the European Union; and

Digitized by Google

nongovernmental organizations. The certification system was expected to be completed by the end of 2002; Angola and Sierra Leone introduced diamond certification in early 2001 in response to United Nations sanctions.

Outlook.—Regional production of rough diamond is expected to rise by 0.9% in 2002, and 1.1% per year from 2003 to 2007. By 2005, production was likely to fall by nearly 1.6% in Botswana and by 7% in Congo (Kinshasa). Production is expected to rise in South Africa and Angola by 25% and 36%, respectively; these increases would more than offset the decreases in Botswanan and Congolese output. In Angola, increasing output would be attributable to the expansion of the Catoca Mine and the reopening of the Camafuca-Camazba Mine. South Africa's production is likely to rise because of several projects, which will include the expansion of the Premier C-Cut Mine and the opening of the Klipspringer mine. By 2007, Namibia's diamond production would rise by nearly 68% because of the opening of the Luderitz Bay marine mine and the expansion of Namdeb's operations (table 21).

Gemstones.—*Production.*—Africa's production of ruby increased to 7,990 kg in 2001 from 6,970 kg in 2000; the slight decrease in Kenyan production was more than offset by rising output in Madagascar and Tanzania. Regional output of sapphire increased to 22,046 kg in 2001 from 13,688 kg in 2000 mostly because of higher production in Madagascar. In recent years, the production of ruby and sapphire in Madagascar has increased because of the discovery of new sapphire deposits at Ilakaka and ruby deposits at Andilamena and Vatomandry. Kenya, which was the largest producer of ruby and sapphire in Africa, accounted for 73% of ruby production and 45% of sapphire output (tables 22, 23). Zambia was the largest regional producer of emerald.

Tanzanite production fell to 5,473 kg in 2001 from 5,516 kg in 2000 after increasing from 810 kg in 1997 (table 24). Tanzania was the world's only producer of tanzanite.

Outlook.—Political instability in Madagascar could result in lower production of ruby and sapphire in 2002. African Gem Resources Ltd. plans to start commercial production of tanzanite from block C of the Merelani mining area starting in the third quarter of 2002; the company's production would amount to more than 200 kilograms per year.

Phosphate Rock.—*Production.*—In 2001, the phosphorus pentoxide (P_2O_5) content of African phosphate rock production fell to 12.5 Mt from 12.6 Mt in 2000. Morocco's output increased by 2.8%, and Egypt's, 40%. Production fell in Senegal by 8.9%; South Africa, 13.5%; Togo, 24%; and Tunisia, 2.4%. Morocco was the leading producer of phosphate rock in Africa, accounting for for 59% of continental phosphate rock output. Tunisia's share of African production was 20%; South Africa, 7%; and Senegal, 5%. In 2001, Africa produced about 30% of the world's phosphate rock (tables 25, 30).

Consumption and outlook.—The Food and Agricultural Organization (2001a) of the United Nations predicted that African consumption of nitrogen fertilizers would increase to nearly 2.79 Mt in 2005-06 from 2.72 Mt in 2002-03 and 2.53 Mt in 2001-02. Africa's consumption of phosphate fertilizers is expected to increase to nearly 1.14 Mt in 2005-06 from 1.07 Mt in 2002-03 and 1.04 Mt in 2001-02. By 2005-06, potash fertilizer consumption was expected to increase to 650,000 t from 580,000 t in 2002-03 and 2001-02. In 2001-02, the Food and Agricultural Organization (2001a) predicted that Africa would account for about 3% of the world's nitrogenous and phosphate fertilizer consumption and 2% of the world's potash demand.

The P_2O_5 content of African phosphate rock production is expected to increase to 12.9 Mt in 2003, 13.3 Mt in 2005, and 14.3 Mt in 2007. Morocco is expected to account for most of the increase in production; planned expansions by Office Cherifien des Phosphates would increase Morocco's production by nearly 14% by 2007. Togo's production is likely to more than triple by 2007. In South Africa, production is expected to fall by nearly 17%; the country's share of African phosphate rock output would decline to 6% (table 25).

Mineral Fuels

Coal.—*Production.*—In 2001, regional anthracite and bituminous coal production remained unchanged. Output fell in Botswana, Morocco, South Africa, and Zambia. Production increased by 6.7% in Zimbabwe. South Africa, which was the dominant coal producer in Africa, accounted for 97% of regional coal output; Zimbabwe, 2%; and others, 1%. More than 99% of South Africa's coal production was bituminous. Africa accounted for about 6% of world anthracite and bituminous coal production; the continent did not produce lignite coal in 2001 (tables 26, 30).

Consumption.—Africa accounted for about 4% of the world's coal consumption in 2001. Within the region, South Africa accounted for 91% of African coal consumption. From 1996 to 2001, Africa's consumption of coal fell by about 1.3% (British Petroleum plc, 2002, p. 33).

Outlook.—African production of coal is expected to increase to 241 Mt in 2005 and 258 Mt in 2007. South Africa is likely to account for most of the region's increase in coal output; national production could reach 225 Mt in 2003, 235 Mt in 2005, and 250 Mt in 2007. Rising production would be partially attributable to the opening of the Kriel South Mine. The National Development Corporation of Tanzania received favorable results in its feasibility study to develop the Mchuchuma bituminous coalfield in 2001. Production from Mchuchuma could increase national coal output to 1.6 Mt by 2007 (table 26).

Natural Gas.—*Production.*—Regional production of natural gas increased by 10.1% in 2001. The majority of the increase was attributable to Nigeria where output rose by 61.5%. Production also increased in Algeria, South Africa, and Tunisia. In 2001, Algeria accounted for 66% of Africa's natural gas output; Egypt, 13%; and Nigeria, 13%. Nigeria's share of continental natural gas output was 5% in 1995 (table 27). Africa accounted for about 6% of world natural gas production in 2001.

Consumption.—The African continent consumed about 2.5% of the world's natural gas. Africa's consumption rose to 60.2

Digitized by Google

billion cubic meters in 2001 compared with 55.5 billion cubic meters in 2000 and 47 billion cubic meters in 1996. Algeria accounted for nearly 36% of Africa's natural gas consumption; Egypt, 35%; and others, 29%. In 1996, Algeria's and Egypt's shares of regional natural gas consumption were 46% and 24%, respectively (British Petroleum plc, 2002, p. 25).

Outlook.—African production of natural gas is expected to decrease by 1.3% in 2002 before increasing by 6.3% in 2003 and 7.5% per year from 2004 to 2007. Algeria's output of natural gas is likely to increase to 122 billion cubic meters by 2007 because of new production from Amenas, Ohanet, and Salah that will start in 2003 and 2004. In spite of its rising production, Algeria's share of African natural gas output is likely to fall to 54% (table 27).

Egypt's production is expected to rise to 31 billion cubic meters in 2003 before falling to 29 billion cubic meters in 2005 and 2007. New sources of production would include the Rosetta and West Delta Deep Marine Fields. In Libya, output is likely to about triple to 17 billion cubic meters by 2005 and to increase to 27 billion cubic meters in 2007. The opening of Sirte Basin and Wafa is expected to contribute to rising production. In Angola, which was a small producer of natural gas in 2001, the development of new petroleum projects is expected to lead to sharply rising natural gas output by 2005. Other projects likely to contribute to higher natural gas production include Songo Songo in Tanzania and Temane in Mozambique, which were expected to be commissioned in 2004 (table 27).

Petroleum.—*Production.*—In 2001, African crude petroleum production increased by 1.8%. Nigeria's output rose by 5.1%, which more than offset the modest decreases in production in Algeria, Angola, Egypt, and Libya. Nigeria accounted for 29% of regional crude petroleum production; Libya, 18%; Algeria, 17%; Egypt, 10%; and Angola, 10%. In 2001, Africa's share of world crude petroleum production amounted to 11% (tables 28, 30).

Consumption.—Regional consumption of petroleum products increased to nearly 909 million barrels (Mbbl) in 2001 from 899 Mbbl in 2000 and 820 Mbbl in 1996; Africa accounted for about 3% of the world's petroleum products consumption. Egypt accounted for 22% of African consumption of petroleum products; South Africa, 20%; Algeria, 8%; and others, 50% (British Petroleum plc, 2002, p. 9).

Outlook.—Africa's production of crude petroleum is expected to increase by 0.4% in 2002, 20.1% in 2003, and 5.7% per year from 2004 to 2007. Nigeria's output is likely to increase to 1 billion barrels (Gbbl) in 2003, 1.35 Gbbl in 2005, and 1.5 Gbbl in 2007. Sources of additional production would include the Agbami, Bongo, Bongo Southwest, Erha, Okono, Okpoho, and Yoho/Awawa Fields. In Angola, production is expected to increase to 620 Mbbl in 2007 from 571 Mbbl in 2005 and 365 Mbbl in 2002; this increase is likely to result from development that is based on new deepwater discoveries in blocks 14, 15, 17, and 18. Nigeria's and Angola's shares of African crude petroleum production are expected to rise to 35% and 15%, respectively. Production is also expected to rise substantially in Algeria and Libya (table 28); the majority of the increase in Algerian output would come from the Ourhoud Field.

Uranium.—*Production.*—In 2001, African uranium output amounted to 6,238 t, which was a decrease of 3.6% from 2000 and 11.8% from 1995. Namibia's production decreased by 17.5%; output increased by 6.9% and 4.9% in Niger and South Africa, respectively. Africa's share of global uranium production amounted to 17% in 2001. Niger accounted for 50% of African uranium production; Namibia, 36%; and South Africa, 14% (tables 29, 30).

Consumption.—South Africa was the only regional consumer of uranium in 2001; Africa accounted for less than 1% of world uranium demand.

Outlook.—Regional production is likely to fall by 1.4% in 2002 and rise by 1.6% per year from 2004 to 2007. Output was expected to fall in South Africa because of the depletion of higher grade ore; production was also likely to decrease in Niger. These decreases are expected to be more than offset by higher production from the Rossing Mine in Namibia (table 29). The U.S. Department of Energy (2001§) predicted that Africa's consumption of uranium would rise by less than 1% per year from 2000 to 2010.

Trade Review and Outlook

Africa's current account surplus fell to 0.3% of GDP in 2001 from 1.2% of GDP in 2000. South Africa had a current account deficit of 0.1% of GDP and other sub-Saharan countries ran an average deficit of 3% of GDP in 2001. Africa's modest trade surplus was mostly attributable to petroleum from oil exporting countries (International Monetary Fund, 2002, p. 49).

Oil-importing countries had an average deficit of 2.2% of GDP in 2001, which was a decrease from 3% of GDP in 2000. Oil-exporting countries ran an average surplus of 7.1% of GDP in 2001, which was a decrease from 13% of GDP in 2000. The average current account deficit for oil-importing countries is expected to increase to 3.2% of GDP in 2002 and 3.4% of GDP in 2003. For oil-exporting countries, the surplus is predicted to fall to 2.3% of GDP in 2002 before rising to 3.4% of GDP in 2003. Africa's current account is expected to return to a deficit of 1.7% of GDP in 2002 and 1.8% of GDP in 2003. An increase in gold and other metals prices would be more than offset by declining terms of trade for oil exporters (International Monetary Fund, 2002, p. 49).

Mineral fuels accounted for at least 90% of the export earnings of Algeria, Congo (Brazzaville), Equatorial Guinea, Libya, and Nigeria. Other significant sources of mineral export earnings included aluminum in Ghana and Mozambique; bauxite in Guinea; copper in Zambia; diamond in Angola, Botswana, Congo (Kinshasa), Namibia, and South Africa; and gold in Mali, South Africa, and Tanzania. Mineral exports accounted for more than one-third of the value of total exports in at least 23 African countries and more than two-thirds in at least 13 countries (table 32).

Environment

Deforestation resulting from fuel use and land-intensive agricultural production continues to be a significant

Digitized by Google

environmental issue in Africa. From 1990 to 2000, forest cover decreased at a rate of 0.8% per year compared with the global rate of 0.2% per year. The most rapid deforestation occurred in Burundi, which lost forest cover at a rate of 9% per year; Comoros, 4.3%; Rwanda, 3.9%; and Niger, 3.7% (Food and Agricultural Organization of the United Nations, 2001b, p. 31, 34). The economic losses from deforestation, such as soil erosion and desertification, have led to plans to increase hydroelectric power capacity in Ethiopia and Uganda and discussions of increasing peat production in Burundi.

The West African Pipeline Project could also help mitigate the effects of deforestation in Africa and reduce the emissions of greenhouse gases. Some of the natural gas that is currently being flared by Nigeria will be exported to Togo, Benin, and Ghana, which have deforestation rates of 3.4%, 2.3%, and 1.7%, respectively (Food and Agricultural Organization of the United Nations, 2001b, p. 31). The Government of Nigeria has committed to ending the flaring of natural gas by 2010, which will also lead to decreased pollution.

The use of mercury by artisanal gold miners has led to serious air and water pollution in such African countries as Ghana, Kenya, Mozambique, South Africa, Sudan, Tanzania, and Zimbabwe. The United Nations Industrial Development Organization (UNIDO) is formulating a plan that would assist Sudan, Tanzania, and Zimbabwe in introducing cleaner artisanal mining technologies. UNIDO was already involved in reducing mercury pollution from artisanal gold mining in Ghana (United Nations Industrial Development Organization, 2001§).

Artisanal mining of gemstones also caused considerable environmental damage in Kenya, Madagascar, and Tanzania. In February, the Government of Madagascar closed the Vatomandry ruby deposit to mining to prevent the environmental, health, and smuggling problems that resulted from unregulated mining at Ilakaka in 1999 and 2000.

In April, a new mining law that replaced regulations that dated back to 1964 was passed in Cameroon. A new provision of the law requires companies to present an environmental impact assessment and sign a mining convention with the Government setting out and guaranteeing investment terms.

In Kenya, new environmental laws that affect most types of mining operations came into effect in January. The High Court of Kenya issued an injunction to prevent Tiomin Resources Inc. from engaging in exploration or development of the Kwale titanium project. The court cited the new environmental legislation to support its decision to halt the Kwale Project until more information was available on its environmental effects.

In April, the Government of Mauritius announced plans to ban sand extraction from the Port Louis lagoon to protect the marine environment and tourist industry; the ban would become effective in October 2002.

In 2001, several projects that had been controversial for environmental reasons moved substantially closer to development. In Madagascar, the Government granted QIT-Madagascar Minerals SA an environmental permit for the development of the titanium deposits near Tolagnaro. The World Bank approved funding for the Bujagali hydropower project in Uganda and the Songo Songo natural gas project in Tanzania.

References Cited

British Petroleum plc, 2002, Statistical review of world energy 2001: London, United Kingdom, British Petroleum plc, 40 p.

Denver Post, 2001, Conflict diamonds: Denver Post, November 30, p. C1.

Even-Zohar, Chaim, 2002, Diamond margins under pressure: Mining Journal, no. 8689, June 14, p. 437-438.

Food and Agricultural Organization of the United Nations, 2001a, Current world fertilizer trend and outlook to 2005/06: Rome, Italy, Food and Agricultural Organization of the United Nations, 14 p.

Food and Agricultural Organization of the United Nations, 2001b, The global forest resource assessment 2000 summary report: Committee on Forestry, 15th, Rome, Italy, March 12-16, 2001, Proceedings, 14 p.

Goreux, Louis, 2001, Conflict diamonds: Washington, DC, World Bank, 30 p.

Hinde, Christopher, 2001, Mining in Africa: Prospectors and Developers Association of Canada International Conference, Trade Show, and Investors Exchange, Toronto, Ontario, Canada, March 11-14, 2001, Presentation, 8 p.

International Iron and Steel Institute Committee on Economic Studies, 2002, Steel statistical yearbook 2002: Brussels, Belgium, International Iron and Steel Institute Committee on Economic Studies, 111 p.

International Monetary Fund, 2002, World economic outlook—Trade and finance: Washington, DC, International Monetary Fund, September 25, 235 p.

World Bureau of Metal Statistics, 2000, World metal statistics: World Bureau of Metal Statistics, v. 53, no. 11, November, 150 p.

World Bureau of Metal Statistics, 2002, World metal statistics: World Bureau of Metal Statistics, v. 55, no. 9, September, 150 p.

Internet References Cited

MEPS (International) Ltd., 2002, Global iron and steel production to 2006, Abstract, accessed April 23, 2002, via URL http://www.meps.co.uk/Global%20Tables.html.

Metals Economics Group, 2001 (November), Exploration spending drops to its lowest level in nine years, Press Release, accessed November 22, at URL http://www.metalseconomics.com/catalog/pages/press2001.htm.

United Nations Industrial Development Organization, 2001 (February 14), Artisanal gold mining without mercury pollution, Feature, accessed November 22, 2002, at URL http://www.unido.org/en/doc/4571.

United States Department of Energy, 2001 (May 1), World annual uranium requirement projections by region and reference case, 2000-2020, accessed November 22, 2002, at URL http://www.eia.doe.gov/cneaf/nuclear/page/forecast/annura.html.

Digitized by Google

TABLE 1
AFRICA: HISTORIC AND PROJECTED ALUMINUM PRODUCTION, 1990-2007

(Thousand metric tons)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Cameroon	93	79	86	81	90	90	90	90
Egypt	179	180	193	189	190	200	200	200
Ghana	174	135	142	162	140	140	160	140
Kenya	--	2	2	2	2	2	2	2
Mozambique	--	--	54	266	270	330	500	510
Nigeria	--	--	--	--	--	--	190	190
South Africa	159	229	674	662	670	675	825	825
Total	605	625	1,150	1,360	1,360	1,440	1,970	1,950

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.

TABLE 2
AFRICA: HISTORIC AND PROJECTED BAUXITE PRODUCTION, 1990-2007

(Thousand metric tons)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Ghana	381	513	504	715	750	800	1,000	1,000
Guinea	15,800	15,800	15,700	15,700	15,700	16,000	16,000	16,000
Mozambique	7	11	8	9	(1/)	(1/)	(1/)	(1/)
Sierra Leone	1,430	--	--	--	(1/)	(1/)	(1/)	(1/)
Undistributed	--	--	--	--	10	10	10	10
Total	17,600	16,300	16,200	16,400	16,500	16,800	17,000	17,000

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.
1/ Included in "Undistributed."

TABLE 3
AFRICA: HISTORIC AND PROJECTED COPPER MINE PRODUCTION, 1990-2007

(Metal content in thousand metric tons)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Botswana	25	25	22	20	20	20	18	18
Congo (Kinshasa)	509	29	21	21	57	70	70	130
Morocco	16	14	7	6	6	6	6	6
Namibia	28	23	5	27	25	25	25	25
South Africa	179	166	137	142	132	118	123	113
Tanzania	--	--	--	3	4	4	4	4
Zambia	519	316	249	312	320	360	420	500
Zimbabwe	14	9	2	2	2	2	--	--
Total	1,290	582	443	533	566	605	670	800

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.

Digitized by Google

TABLE 4
AFRICA: HISTORIC AND PROJECTED REFINED COPPER PRODUCTION, 1990-2007

(Thousand metric tons)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Congo (Kinshasa)	339	35	21	21	57	70	70	130
Egypt	4	4	5	5	5	5	5	5
South Africa	133	124	126	132	122	109	114	104
Zambia	438	328	227	296	290	320	420	500
Zimbabwe	14	7	10	2	15	12	10	10
Total	928	498	389	456	490	520	620	750

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
-- Negligible or no production.

TABLE 5
AFRICA: HISTORIC AND PROJECTED GOLD MINE PRODUCTION, 1990-2007

(Metal content in kilograms)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Algeria	--	--	--	300	(1/)	(1/)	(1/)	(1/)
Benin	--	300	500	500	(1/)	(1/)	(1/)	(1/)
Botswana	46	86	4	2	(1/)	(1/)	(1/)	(1/)
Burkina Faso	7,800	1,319	1,000	1,000	(1/)	(1/)	(1/)	(1/)
Burundi	9	2,000	--	415	(1/)	(1/)	(1/)	(1/)
Cameroon	10	800	1,000	1,000	(1/)	(1/)	(1/)	(1/)
Central African Republic	241	97	12	20	(1/)	(1/)	(1/)	(1/)
Chad	--	--	120	150	(1/)	(1/)	(1/)	(1/)
Congo (Brazzaville)	7	10	10	10	(1/)	(1/)	(1/)	(1/)
Congo (Kinshasa)	9,300	1,180	52	50	50	50	50	5,000
Cote d'Ivoire	20	1,983	3,154	3,100	3,000	3,000	3,000	3,000
Equatorial Guinea	50	50	500	500	(1/)	(1/)	(1/)	(1/)
Eritrea	--	59	264	270	(1/)	(1/)	(1/)	(1/)
Ethiopia	848	4,500	5,177	5,200	5,300	5,300	5,300	5,300
Gabon	80	70	70	70	(1/)	(1/)	(1/)	(1/)
Ghana	16,800	53,087	72,080	68,699	72,400	69,800	66,700	75,700
Guinea	6,340	7,863	13,104	13,000	13,500	14,000	15,000	19,000
Kenya	25	170	1,243	1,200	(1/)	(1/)	(1/)	(1/)
Liberia	600	800	1,000	1,000	(1/)	(1/)	(1/)	(1/)
Madagascar	216	38	5	--	(1/)	(1/)	(1/)	(1/)
Mali	5,200	3,996	28,717	42,288	44,000	45,000	50,000	55,000
Mauritania	--	1,196	1,000	1,000	(1/)	(1/)	(1/)	(1/)
Morocco	500	580	505	1,190	2,000	3,000	3,000	3,000
Mozambique	63	6,800	23	25	(1/)	(1/)	(1/)	(1/)
Namibia	1,610	2,394	2,417	2,851	(1/)	(1/)	(1/)	(1/)
Niger	--	1,000	1,000	1,000	(1/)	(1/)	(1/)	(1/)
Nigeria	--	5	10	10	(1/)	(1/)	(1/)	(1/)
Rwanda	2,160	26	10	10	(1/)	(1/)	(1/)	(1/)
Senegal	--	--	550	550	(1/)	(1/)	(1/)	(1/)
Sierra Leone	32	4	30	30	(1/)	(1/)	(1/)	(1/)
South Africa	605,000	523,809	430,816	394,535	395,000	451,000	454,000	478,000
Sudan	100	3,700	5,770	5,800	5,000	5,000	4,000	--
Tanzania	3,500	320	15,060	30,088	37,000	44,000	52,000	52,000
Uganda	--	1,506	56	--	(1/)	(1/)	(1/)	(1/)
Zambia	129	91	600	130	(1/)	(1/)	(1/)	(1/)
Zimbabwe	16,900	23,959	22,069	18,050	14,000	11,500	10,000	10,000
Undistributed	--	--	--	--	12,000	13,000	13,000	10,000
Total	678,000	644,000	608,000	594,000	603,000	665,000	676,000	716,000

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.
1/ Included in "Undistributed."

Digitized by Google

TABLE 6
AFRICA: HISTORIC AND PROJECTED IRON ORE MINE PRODUCTION, 1990-2007

(Thousand metric tons of Fe content)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Algeria	1,470	1,100	820	750	750	750	750	750
Egypt	1,330	1,120	1,380	1,380	1,380	1,380	1,380	1,380
Kenya	--	--	--	--	(1/)	(1/)	(1/)	(1/)
Mauritania	6,800	7,000	7,500	7,300	6,820	6,820	6,820	6,820
Morocco	90	32	4	4	(1/)	(1/)	(1/)	(1/)
Nigeria	138	62	--	--	(1/)	(1/)	(1/)	(1/)
South Africa	19,800	19,800	21,570	22,244	22,600	22,300	23,600	23,600
Tanzania	--	14	--	--	(1/)	(1/)	(1/)	(1/)
Tunisia	154	122	98	109	(1/)	(1/)	(1/)	(1/)
Uganda	--	--	3	1	(1/)	(1/)	(1/)	(1/)
Zimbabwe	730	160	225	180	(1/)	(1/)	(1/)	(1/)
Undistributed	--	--	--	--	250	350	450	450
Total	30,500	29,400	31,600	32,000	31,800	31,600	33,000	33,000

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
-- Negligible or no production.
1/ Included in "Undistributed."

TABLE 7
AFRICA: HISTORIC AND PROJECTED STEEL PRODUCTION, 1990-2007

(Thousand metric tons)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Algeria	836	827	842	850	800	800	900	900
Benin	8	--	--	--	(1/)	(1/)	(1/)	(1/)
Congo (Kinshasa)	NA	NA	80	80	(1/)	(1/)	(1/)	(1/)
Egypt	2,240	2,642	2,820	3,800	4,360	4,000	4,000	4,000
Kenya	20	20	--	--	(1/)	(1/)	(1/)	(1/)
Libya	492	909	1,055	900	886	1,000	1,300	1,300
Morocco	7	7	5	5	(1/)	(1/)	(1/)	(1/)
Nigeria	220	36	--	--	(1/)	(1/)	(1/)	(1/)
South Africa	8,620	8,741	8,481	8,821	8,800	9,000	9,000	9,000
Tunisia	177	201	237	239	(1/)	(1/)	(1/)	(1/)
Uganda	--	12	7	7	(1/)	(1/)	(1/)	(1/)
Zimbabwe	580	210	258	156	(1/)	(1/)	(1/)	(1/)
Undistributed	--	--	--	--	450	450	800	1,300
Total	13,200	13,600	13,800	14,900	15,300	15,300	16,000	16,500

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
-- Negligible or no production.
1/ Included in "Undistributed."

Digitized by Google

TABLE 8
AFRICA: HISTORIC AND PROJECTED LEAD MINE PRODUCTION, 1990-2007

(Metal content in metric tons)

Country 1/	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Algeria	1,100	1,383	818	900	900	900	900	900
Morocco	68,800	67,708	81,208	76,747	80,000	85,000	90,000	90,000
Namibia	18,000	16,084	11,114	13,025	14,800	15,800	15,800	20,000
South Africa	69,400	88,449	75,280	50,771	49,000	70,000	84,000	84,000
Tunisia	2,970	6,601	6,602	6,820	6,900	6,900	6,900	6,900
Total	160,000	180,000	175,000	148,000	152,000	179,000	198,000	202,000

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
1/ Nigeria also mined small amounts of lead.

TABLE 9
AFRICA: HISTORIC AND PROJECTED PRIMARY REFINED LEAD PRODUCTION, 1990-2007

(Metric tons)

Country 1/	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Algeria	1,000	800	6,100	6,000	6,000	6,000	6,000	6,000
Morocco	64,000	59,673	66,812	58,178	58,000	60,000	60,000	60,000
Namibia	35,100	26,752	--	--	--	--	--	--
Total	100,000	87,200	72,900	64,200	64,000	66,000	66,000	66,000

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
-- Negligible or no production.
1/ Nigeria also refined a small quantity of primary lead.

TABLE 10
AFRICA: HISTORIC AND PROJECTED SECONDARY REFINED LEAD PRODUCTION, 1990-2007

(Metric tons)

Country 1/	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Algeria	3,500	7,500	--	--	--	--	--	--
Kenya	2,400	2,000	1,000	1,000	1,000	1,000	1,000	1,000
Morocco	2,000	2,600	3,000	3,000	3,000	3,000	3,000	3,000
Nigeria	--	4	5	5	--	--	--	--
South Africa	31,200	32,100	46,124	48,909	50,000	50,000	50,000	50,000
Total	39,100	44,200	50,100	52,900	54,000	54,000	54,000	54,000

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
-- Negligible or no production.
1/ Uganda also refined a small quantity of secondary lead.

TABLE 11
AFRICA: HISTORIC AND PROJECTED NICKEL MINE PRODUCTION, 1990-2007

(Metal content in metric tons)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Botswana	23,200	18,088	20,286	18,585	20,000	25,000	25,000	28,000
South Africa	29,000	30,700	36,616	36,443	38,300	36,000	40,000	60,000
Zimbabwe	13,500	11,721	8,160	10,120	9,500	9,500	10,900	11,900
Total	65,700	60,500	65,100	65,100	67,800	71,000	76,000	100,000

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

Digitized by Google

TABLE 12
AFRICA: HISTORIC AND PROJECTED PLATINUM MINE PRODUCTION, 1990-2007

(Metal content in kilograms)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
South Africa	87,800	102,300	114,459	129,746	132,000	135,000	138,000	140,000
Zimbabwe	21	7	505	519	1,500	4,400	4,800	5,000
Total	87,800	102,000	115,000	130,000	134,000	139,000	143,000	145,000

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 13
AFRICA: HISTORIC AND PROJECTED PALLADIUM MINE PRODUCTION, 1990-2007

(Metal content in kilograms)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
South Africa	38,300	51,000	58,818	62,142	62,700	64,800	66,200	67,200
Zimbabwe	31	17	366	371	1,080	3,170	3,460	3,600
Total	38,300	51,000	59,200	62,500	63,800	68,000	69,700	70,800

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.

TABLE 14
AFRICA: HISTORIC AND PROJECTED SILVER MINE PRODUCTION, 1990-2007

(Metal content in kilograms)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Algeria	2,500	2,000	1,400	1,700	1,700	1,700	1,700	1,700
Congo (Kinshasa)	84,000	900	--	--	--	--	--	5,000
Ghana	840	2,660	6,100	1,945	3,600	3,500	3,400	3,800
Mali	270	250	--	--	--	--	--	--
Morocco	241,000	204,000	289,000	280,000	285,000	290,000	300,000	300,000
Namibia	92,100	69,000	9,287	12,679	12,700	13,000	14,000	15,000
South Africa	161,000	174,279	144,143	109,570	110,000	110,000	123,000	132,000
Tanzania	--	--	1,384	6,861	9,200	10,300	10,900	10,900
Tunisia	930	4,000	3,700	3,650	3,700	3,700	3,700	3,700
Zambia	17,000	8,676	4,710	6,290	6,300	6,300	9,100	10,800
Zimbabwe	21,200	15,640	3,799	3,449	3,400	2,800	2,300	2,300
Total	621,000	481,000	464,000	426,000	436,000	440,000	470,000	490,000

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
-- Negligible or no production.

Digitized by Google

TABLE 15
AFRICA: HISTORIC AND PROJECTED TIN MINE PRODUCTION, 1990-2007

(Metal content in kilograms)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Burundi	54	15	7	4	5	5	5	5
Cameroon	3	2	--	--	--	--	--	--
Congo (Kinshasa)	100	--	--	--	--	--	--	20
Namibia	900	--	--	--	--	--	--	--
Niger	38	20	22	20	20	20	20	20
Nigeria	145	250	200	130	150	150	200	200
Tanzania	15	3	--	--	--	--	--	--
Rwanda	510	242	276	171	170	220	220	220
South Africa	1,140	--	--	--	--	--	--	--
Uganda	25	43	6	18	20	20	20	20
Zambia	1	--	--	--	--	--	--	--
Zimbabwe	1,120	10	--	--	--	--	--	--
Total	4,050	585	511	343	365	420	460	490

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
-- Negligible or no production.

TABLE 16
AFRICA: HISTORIC AND PROJECTED TIN METAL PRODUCTION, 1990-2007

(Metric tons)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Congo (Kinshasa)	90	--	--	--	--	--	--	--
Nigeria	130	259	25	25	25	25	30	30
Rwanda	--	--	--	--	80	200	200	200
South Africa	1,210	--	--	--	--	--	--	--
Total	1,430	259	25	25	105	225	230	230

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.

TABLE 17
AFRICA: HISTORIC AND PROJECTED ILMENITE MINE PRODUCTION, 1990-2007

(Thousand metric tons of TiO_2)

Country	1990 e/	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Egypt	--	30	66	66	69	69	69	69
Kenya	--	--	--	--	--	--	150	150
Mozambique	--	--	--	--	--	--	490	690
Sierra Leone	33	--	--	--	--	50	50	50
South Africa	567	890	954	928	930	1,000	1,090	1,090
Total	600	920	1,020	994	1,000	1,120	1,850	2,050

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
-- Negligible or no production.

Digitized by Google

TABLE 18
AFRICA: HISTORIC AND PROJECTED TUNGSTEN MINE PRODUCTION, 1990-2007

(Metal content in metric tons)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Burundi	--	22	--	--	--	--	--	--
Rwanda	84	47	108	148	150	150	150	150
Uganda	4	17	--	17	115	115	270	270
Total	88	86	108	165	265	265	420	420

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
-- Negligible or no production.

TABLE 19
AFRICA: HISTORIC AND PROJECTED ZINC MINE PRODUCTION, 1990-2007

(Metal content in metric tons)

Country 1/	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Algeria	4,160	7,174	10,452	12,000	12,000	12,000	12,000	12,000
Congo (Kinshasa)	61,800	4,500	215	1,014	1,000	1,000	--	50,000
Morocco	18,800	79,947	103,064	89,339	90,000	100,000	110,000	115,000
Namibia	37,700	30,209	39,126	31,803	32,000	80,000	180,000	180,000
South Africa	75,000	70,241	62,703	61,221	60,000	35,000	35,000	35,000
Tunisia	3,960	44,244	41,247	40,000	40,000	40,000	40,000	40,000
Total	201,000	236,000	257,000	235,000	235,000	270,000	380,000	430,000

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
-- Negligible or no production.
1/ Nigeria also mined a small quantity of zinc.

TABLE 20
AFRICA: HISTORIC AND PROJECTED ZINC METAL PRODUCTION, 1990-2007

(Metal content in metric tons)

Country 1/	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Algeria	23,600	30,000	34,000	34,000	34,000	34,000	34,000	34,000
Congo (Kinshasa)	38,200	--	--	--	--	--	--	50,000
Namibia	--	--	--	--	--	150,000	150,000	150,000
South Africa	92,000	98,782	103,000	109,000	100,000	100,000	100,000	100,000
Total	154,000	129,000	137,000	143,000	134,000	280,000	280,000	330,000

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.
1/ Nigeria also refined a small quantity of zinc.

Digitized by Google

TABLE 21
AFRICA: HISTORIC AND PROJECTED DIAMOND MINE PRODUCTION, 1990-2007

(Thousand carats)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Angola	1,130	2,900	4,313	5,159	5,500	6,000	7,000	7,000
Botswana	17,400	16,802	24,635	26,416	27,000	27,000	26,000	26,000
Central African Republic	381	530	461	480	(1/)	(1/)	(1/)	(1/)
Congo (Kinshasa)	19,400	22,024	17,700	18,200	18,000	18,000	17,000	17,000
Cote d'Ivoire	12	75	320	320	(1/)	(1/)	(1/)	(1/)
Gabon	1	1	1	1	1	1	1	1
Ghana	650	632	920	870	(1/)	(1/)	(1/)	(1/)
Guinea	127	365	369	370	(1/)	(1/)	(1/)	(1/)
Lesotho	NA	NA	2	1	1	1	1	1
Liberia	100	150	170	170	(1/)	(1/)	(1/)	(1/)
Namibia	763	1,382	1,542	1,490	1,500	1,500	2,000	2,500
Sierra Leone	78	214	600	600	(1/)	(1/)	(1/)	(1/)
South Africa	8,710	9,683	10,805	11,167	11,000	11,000	14,000	14,000
Tanzania	85	50	354	254	(1/)	(1/)	(1/)	(1/)
Zimbabwe	--	204	17	15	(1/)	(1/)	(1/)	(1/)
Undistributed	--	--	--	--	3,100	3,300	3,200	3,200
Total	48,800	55,000	62,200	65,500	66,100	67,000	69,000	70,000

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. NA Not available. -- Negligible or no production.
1/ Included in "Undistributed."

TABLE 22
AFRICA: RUBY PRODUCTION, 1995-2001 1/

(Kilograms)

Country	1995	1996	1997	1998	1999	2000	2001
Kenya	1,200	1,200	5,175	4,001	4,488	5,896	5,862
Madagascar	73	92	21	31	6	3	941
Malawi	5	6	20	20	15	--	15
Tanzania	800	800	900	1,000	1,000	1,070	1,174
Total	2,100	2,100	6,100	5,050	5,510	6,970	7,990

-- Negligible or no production.
1/ Totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 23
AFRICA: SAPPHIRE PRODUCTION, 1995-2001 1/

(Kilograms)

Country	1995	1996	1997	1998	1999	2000	2001
Kenya	2,300	2,300	615	3,313	7,232	10,686	10,000
Madagascar	99	110	3,957	2,874	3,810	471	8,470
Tanzania	2,000	2,200	2,400	2,450	2,500	2,531	3,576
Total	4,400	4,610	6,970	8,640	13,500	13,700	22,000

1/ Totals are rounded to no more than three significant digits; may not add to totals shown

TABLE 24
AFRICA: TANZANITE PRODUCTION, 1997-2001

(Kilograms)

Country	1997	1998	1999	2000	2001
Tanzania	810	1,226	5,216	5,516	5,473

Digitized by Google

TABLE 25
AFRICA: HISTORIC AND PROJECTED PHOSPHATE ROCK PRODUCTION, 1990-2007

(Thousand metric tons of P_2O_5 content))

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Algeria	333	500	265	280	280	310	310	310
Egypt	286	207	300	420	420	420	420	420
Morocco	6,910	6,399	7,200	7,400	7,240	7,400	7,740	8,420
Senegal	823	556	720	656	660	660	660	660
South Africa	1,200	1,101	1,083	937	940	900	900	780
Tanzania	8	2	5	4	5	5	5	5
Togo	840	930	500	380	460	760	760	1,200
Tunisia	1,860	2,181	2,500	2,440	2,460	2,460	2,460	2,460
Zimbabwe	52	45	25	28	26	22	22	38
Total	12,300	11,900	12,600	12,500	12,500	12,900	13,300	14,300

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 26
AFRICA: HISTORIC AND PROJECTED COAL PRODUCTION, 1990-2007

(Thousand metric tons)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Botswana	793	898	947	930	950	950	950	950
Congo (Kinshasa)	100	10	--	1	2	2	10	20
Egypt	--	10	400	400	400	400	400	400
Malawi	41	15	34	34	35	35	35	35
Morocco	526	650	31	2	2	2	2	2
Mozambique	40	40	16	18	20	20	20	20
Niger	154	135	158	160	160	160	160	160
Nigeria	78	29	35	35	35	40	80	100
South Africa	175,000	206,210	224,118	223,500	225,000	225,000	235,000	250,000
Swaziland	151	172	378	380	--	--	300	400
Tanzania	52	43	79	78	80	85	90	1,600
Zambia	382	141	168	150	100	150	150	200
Zimbabwe	5,500	5,538	3,809	4,064	3,200	2,800	3,500	4,000
Total	183,000	214,000	230,000	230,000	230,000	230,000	240,000	260,000

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.

TABLE 27
AFRICA: HISTORIC AND PROJECTED DRY NATURAL GAS PRODUCTION, 1990-2007

(Million cubic meters)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Algeria	48,500	58,100	100,092	105,000	103,000	101,000	111,000	122,000
Angola	538	560	560	574	580	560	3,000	5,500
Congo (Kinshasa)	--	--	--	--	--	30	60	60
Cote d'Ivoire	--	36	1,323	1,230	1,300	1,500	1,200	1,200
Egypt	7,900	12,536	21,000	21,000	21,000	31,000	29,000	29,000
Equatorial Guinea	--	--	98	790	800	1,350	1,350	1,400
Ethiopia	--	--	--	--	--	--	100	100
Gabon	150	150	99	99	100	103	100	100
Libya	6,200	6,345	5,400	5,400	5,400	7,200	17,000	27,000
Morocco	37	22	39	39	38	36	37	35
Mozambique	--	--	60	60	60	60	1,000	1,000
Nigeria	3,230	5,000	13,000	21,000	21,000	21,000	25,000	32,000
Senegal	110	110	56	56	50	41	33	33
South Africa	--	1,980	2,088	3,000	2,500	2,000	1,900	1,900
Sudan	--	--	--	--	--	10	10	10
Tanzania	--	--	--	--	--	400	800	800
Tunisia	200	250	1,600	1,800	1,800	1,900	2,100	2,300
Total	66,900	85,100	145,000	160,000	158,000	168,000	194,000	224,000

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.

Digitized by Google

TABLE 28
AFRICA: HISTORIC AND PROJECTED CRUDE PETROLEUM, INCLUDING CONDENSATE, PRODUCTION, 1990-2007

(Thousand 42-gallon barrels)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Algeria	444,000	438,730	476,288	475,000	479,000	550,000	600,000	600,000
Angola	174,000	232,800	273,020	270,100	365,000	511,000	571,000	620,000
Benin	1,416	654	365	365	--	--	--	--
Cameroon	64,600	39,400	41,000	39,600	29,000	27,000	24,000	24,000
Chad	--	--	--	--	1	30,000	84,000	84,000
Congo (Brazzaville)	58,800	63,875	95,630	103,000	93,000	92,000	90,000	90,000
Congo (Kinshasa)	10,600	10,087	10,300	11,500	9,700	9,400	9,800	9,800
Cote d'Ivoire	770	2,000	11,700	12,000	2,000	3,000	2,600	2,600
Egypt	319,000	335,800	285,000	277,000	230,000	210,000	220,000	220,000
Equatorial Guinea	--	2,300	39,000	69,000	58,000	65,000	90,000	90,000
Gabon	100,000	133,000	118,625	110,000	124,000	120,000	115,000	115,000
Ghana	--	--	2,555	3,285	2,100	2,300	2,200	4,000
Libya	502,000	509,175	538,000	520,000	530,000	650,000	700,000	700,000
Morocco	114	36	35	35	35	35	35	35
Nigeria	660,000	740,000	783,000	823,000	800,000	1,000,000	1,350,000	1,500,000
Senegal	8	2	1	1	--	--	--	--
South Africa	--	--	6,606	13,870	6,400	20,000	20,000	22,000
Sudan	--	730	67,152	77,755	85,000	101,000	164,000	164,000
Tunisia	36,500	32,690	28,207	26,300	24,000	22,000	18,000	18,000
Total	2,370,000	2,540,000	2,780,000	2,830,000	2,840,000	3,410,000	4,060,000	4,260,000

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.

TABLE 29
AFRICA: HISTORIC AND PROJECTED URANIUM PRODUCTION, 1990-2007

(Metal content in metric tons)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Gabon	702	653	--	--	--	--	--	--
Namibia	3,214	2,006	2,714	2,239	2,300	2,300	2,400	2,700
Niger	2,681	2,970	2,895	3,096	3,000	3,000	3,000	3,000
South Africa	2,442	1,443	861	903	850	850	850	850
Total	9,040	7,070	6,470	6,240	6,150	6,150	6,300	6,600

e/ Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.

Digitized by Google

TABLE 30
AFRICA: PRODUCTION OF SELECTED MINERAL COMMODITIES IN 2001 1/

(Thousand metric tons of gross weight unless otherwise specified)

Country	Aluminum	Bauxite	Cement	Chromite	Coal, anthracite and bituminous	Cobalt, mine Co content (metric tons)
Algeria	--	--	8,300	--	--	--
Angola	--	--	350	--	--	--
Benin	--	--	250	--	--	--
Botswana	--	--	--	--	930	325
Burkina Faso	--	--	50	--	--	--
Burundi	--	--	--	--	--	--
Cameroon	81	--	930	--	--	--
Central African Republic	--	--	--	--	--	--
Chad	--	--	--	--	--	--
Congo (Brazzaville)	--	--	100	--	--	--
Congo (Kinshasa)	--	--	100	--	1	4,700
Cote d'Ivoire	--	--	650	--	--	--
Egypt	189	--	24,500	--	400	--
Equatorial Guinea	--	--	--	--	--	--
Eritrea	--	--	47	--	--	--
Ethiopia	--	--	950	--	--	--
Gabon	--	--	210	--	--	--
Ghana	162	715	1,900	--	--	--
Guinea	--	15,700	300	--	--	--
Kenya	2	--	1,085	--	--	--
Lesotho	--	--	--	--	--	--
Liberia	--	--	15	--	--	--
Libya	--	--	3,000	--	--	--
Madagascar	--	--	54	52	--	--
Malawi	--	--	181	--	34	--
Mali	--	--	40	--	--	--
Mauritania	--	--	110	--	--	--
Morocco	--	--	10,000	--	2	1,300
Mozambique	266	9	265	--	18	--
Namibia	--	--	--	--	--	--
Niger	--	--	40	--	160	--
Nigeria	--	--	3,000	--	35	--
Rwanda	--	--	83	--	--	--
Senegal	--	--	1,000	--	--	--
Sierra Leone	--	--	100	--	--	--
Somalia	--	--	--	--	--	--
South Africa	662	--	9,165	5,502	223,500	550
Sudan	--	--	146	21	--	--
Swaziland	--	--	--	--	380	--
Tanzania	--	--	900	--	78	--
Togo	--	--	800	--	--	--
Tunisia	--	--	5,721	--	--	--
Uganda	--	--	416	--	--	--
Zambia	--	--	350	--	150	8,000
Zimbabwe	--	--	1,000	780	4,064	95
Total 2/	1,360	16,400	76,100	6,360	230,000	15,000
World total	24,400	138,000	1,700,000	12,600	3,910,000	36,700
Share of world total	6%	12%	5%	50%	6%	41%
United States	2,637	NA	90,446	--	941,500	--

See footnotes at end of table.

Digitized by Google

TABLE 30--Continued
AFRICA: PRODUCTION OF SELECTED MINERAL COMMODITIES IN 2001 1/

(Thousand metric tons of gross weight unless otherwise specified)

Country	Copper, mine Cu content	Diamond 3/ (thousand carats)	Gold (kilograms)	Graphite	Iron ore	Lead, mine Pb content (metric tons)
Algeria	--	--	300	--	1,500	900
Angola	--	5,159	--	--	--	--
Benin	--	--	500	--	--	--
Botswana	20	26,416	2	--	--	--
Burkina Faso	--	--	1,000	--	--	--
Burundi	--	--	415	--	--	--
Cameroon	--	--	1,000	--	--	--
Central African Republic	--	480	20	--	--	--
Chad	--	--	150	--	--	--
Congo-Brazzaville	--	--	10	--	--	--
Congo-Kinshasa	21	18,200	50	--	--	--
Cote d'Ivoire	--	320	3,100	--	--	--
Egypt	--	--	--	--	2,500	--
Equatorial Guinea	--	--	500	--	--	--
Eritrea	--	--	270	--	--	--
Ethiopia	--	--	5,200	--	--	--
Gabon	--	1	70	--	--	--
Ghana	--	870	68,699	--	--	--
Guinea	--	370	13,000	--	--	--
Kenya	--	--	1,200	--	1	--
Lesotho	--	1	--	--	--	--
Liberia	--	170	1,000	--	--	--
Libya	--	--	--	--	--	--
Madagascar	--	--	--	40	--	--
Malawi	--	--	--	--	--	--
Mali	--	--	42,288	--	--	--
Mauritania	--	--	1,000	--	10,300	--
Morocco	6	--	1,190	--	6	76,747
Mozambique	--	--	25	--	--	--
Namibia	27	1,490	2,851	--	--	13,025
Niger	--	--	1,000	--	--	--
Nigeria	--	--	10	--	--	--
Rwanda	--	--	10	--	--	--
Senegal	--	--	550	--	--	--
Sierra Leone	--	600	30	--	--	--
Somalia	--	--	--	--	--	--
South Africa	142	11,167	394,535	--	34,757	50,771
Sudan	--	--	5,800	--	--	--
Swaziland	--	--	--	--	--	--
Tanzania	3	254	30,088	--	--	--
Togo	--	--	--	--	--	--
Tunisia	--	--	--	--	204	6,820
Uganda	--	--	--	--	1	--
Zambia	312	--	130	--	--	--
Zimbabwe	2	15	18,050	10	361	--
Total 2/	533	65,500	594,000	50	49,600	148,000
World total	13,500	117,000	2,590,000	821	1,060,000	3,200,000
Share of world total	4%	56%	23%	6%	5%	5%
United States	1,340	--	335,000	--	46,192	466,000

See footnotes at end of table.

Digitized by Google

TABLE 30--Continued
AFRICA: PRODUCTION OF SELECTED MINERAL COMMODITIES IN 2001 1/

(Thousand metric tons of gross weight unless otherwise specified)

Country	Manganese, mine Mn content	Petroleum, crude (thousand 42-gallon barrels)	Phosphate rock (gross weight)	Steel, crude	Uranium, concentrate U_3O_8 (metric tons)	Zinc, mine Zn content (metric tons)
Algeria	--	475,000	900	850	--	12,000
Angola	--	270,100	--	--	--	--
Benin	--	365	--	--	--	--
Botswana	--	--	--	--	--	--
Burkina Faso	--	--	--	--	--	--
Burundi	--	--	--	--	--	--
Cameroon	--	39,600	--	--	--	--
Central African Republic	--	--	--	--	--	--
Chad	--	--	--	--	--	--
Congo (Brazzaville)	--	103,000	--	--	--	--
Congo (Kinshasa)	--	11,500	--	80	--	1,014
Cote d'Ivoire	--	12,000	--	--	--	--
Egypt	8	277,000	1,450	3,800	--	--
Equatorial Guinea	--	69,000	--	--	--	--
Eritrea	--	--	--	--	--	--
Ethiopia	--	--	--	--	--	--
Gabon	830	110,000	--	--		--
Ghana	260	3,285	--	--	--	--
Guinea	--	--	--	--	--	--
Kenya	--	--	--	--	--	--
Lesotho	--	--	--	--	--	--
Liberia	--	--	--	--	--	--
Libya	--	520,000	--	900	--	--
Madagascar	--	--	--	--	--	--
Malawi	--	--	--	--	--	--
Mali	--	--	--	--	--	--
Mauritania	--	--	--	--	--	--
Morocco	12	35	21,983 5/	5	--	89,339
Mozambique	--	--	--	--	--	--
Namibia	--	--	--	--	2,640	31,803
Niger	--	--	--	--	3,651	--
Nigeria	--	823,000	--	--	--	--
Rwanda	--	--	--	--	--	--
Senegal	--	1	1,990	--	--	--
Sierra Leone	--	--	--	--	--	--
Somalia	--	--	--	--	--	--
South Africa	1,479	13,870	2,420	8,821	1,065	61,221
Sudan	--	77,755	--	--	--	--
Swaziland	--	--	--	--	--	--
Tanzania	--	--	13	--	--	--
Togo	--	--	1,060	--	--	--
Tunisia	--	26,300	8,144	239	--	40,000
Uganda	--	--	--	7	--	--
Zambia	--	--	--	--	--	--
Zimbabwe	--	--	87	156	--	--
Total 2/	2,590	2,830,000	38,000	14,900	7,360	235,000
World total	7,570	24,900,000	126,000	851,000	42,900	9,000,000
Share of world total	34%	11%	30%	2%	17%	3%
United States	--	2,120,000	31,900	90,100	1,717	842,000

NA Not available. -- Negligible or no production.
1/ Table includes data available through January 2003. Totals are rounded to no more than three significant digits.
2/ May not add to totals shown because of independent rounding.
3/ Excludes synthetic diamond.
4/ Less that ½ unit.
5/ Includes production from Western Sahara.

Digitized by Google

TABLE 31
THE ROLE OF MINERAL EXPORTS IN SELECTED AFRICAN ECONOMIES IN 2001 1/

Country	Value of mineral exports (millions)	Minerals as a percentage of total exports	Major exports
Nigeria	$18,400	98	Crude oil.
Libya	11,000	98	Crude oil and natural gas.
Algeria	18,000	95	Crude oil, natural gas, and petroleum products.
Equatorial Guinea	900	95	Crude oil and methanol.
Congo (Brazzaville)	2,500	90	Crude oil.
Guinea	700	90	Aluminum, bauxite, diamond, and gold.
Sierra Leone	75	90	Bauxite, diamond, and titanium.
Angola (1999)	5,630	89	Crude oil and diamond.
Gabon	2,100	86	Crude oil and manganese.
Botswana	2,210	85	Diamond, nickel, and soda ash.
Sudan	1,430	84	Crude oil, petroleum products, and gold.
Congo (Kinshasa)	1,600	75	Diamond, crude oil, copper, and cobalt.
Zambia	590	68	Copper, cobalt, and gemstones.
Mozambique	410	58	Aluminum and petroleum products.
Mali	287	55	Gold.
Cameroon	1,100	50	Crude oil and aluminum.
Ghana	940	47	Gold, aluminum, diamond, bauxite, and manganese.
Rwanda	41	47	Columbium (niobium)-tantalum, tin, and tungsten.
Zimbabwe	720	42	Platinum, gold, nickel, and lithium.
South Africa (2000)	13,400	41	Platinum, gold, coal, aluminum, iron ore, and ferroalloys.
Tanzania	312	40	Gold, diamond, and gemstones.
Egypt	1,600	39	Crude oil and petroleum products.
Namibia	653	38	Diamond, uranium, copper, and gold.
Morocco	1,500	19	Phosphate, copper, lead, zinc, and iron ore.
Uganda	70	11	Gold, cobalt, columbium (niobium)-tantalum, tin, and tungsten.
Kenya (2000)	195	11	Trona, fluorite, gold, cement, and petroleum products.
Tunisia	595	9	Cement, fertilizer, phosphate rock, and zinc.
Madagascar (2000)	47	6	Chromite, mica, gemstones, and petroleum products.
Total	87,000		

1/ Data for 2001 unless otherwise noted.
Source: U.S. Geological Survey from Government and international development bank reports.

TABLE 32
SELECTED SIGNIFICANT AFRICAN EXPLORATION SITES IN 2001 1/

Location	Type 2/	Site	Commodity	Company	Resource 3/	Exploration 4/
Algeria	E	Amesmessa	Au	Societe d'Exploration des Mines d'Or	1.6 Moz Au	$10 million budget.
Botswana	P	Phoenix	Ni, Cu	LionOre Mining International Ltd.	484,000 t Ni, 283,000 t Cu	Extensive drilling.
Mali	P	Morila	Au	Randgold Resources Ltd.	Data not released	Do.
Do.	F	Tabakoto	Au	Nevsun Resources Ltd.	550,000 oz Au	Do.
South Africa	F	Everest North/South	PGE, Au	Aquarius Platinum Ltd.	7.7 Moz PGE and Au	Feasibility drilling.
Do.	D	Winnaarshoek	PGE, Au	Impala Platinum Holdings Ltd.	68.3 Moz PGE and Au	Extensive drilling.
Tanzania	P	Bulyanhulu	Au	Barrick Gold Corp.	14.2 Moz Au	Do.
Do.	E	Tulawaka	Au	do.	743,000 oz Au	Feasibility drilling.
Zambia	F	Kansanshi	Cu, Au	First Quantum Minerals Ltd.	3.4 Mt Cu, 1.4 Moz Au	Extensive drilling.
Do.	F	Lumwana	Cu, Au, U, Co	Equinox Resources Ltd.	4.8 Mt Cu	Feasibility drilling.
Zimbabwe	F	Murowa/Zvishavane	Diamond	Rio Tinto Zimbabwe	14.8 million carats of diamond	Feasibility study.

1/ Abbreviations used for commodities in this table include the following: Au--gold, Co--cobalt, Cu--copper, Ni--nickel, PGE--platinum-group elements, and U--uranium. Abbreviations used for units of measurement include the following: Moz--million troy ounces, Mt--million metric tons, oz--troy ounces, and t--metric tons.
2/ D--Approved for development; E--Active exploration; F--Feasibility work ongoing/completed; P--Exploration at producing site.
3/ Resources reported where available based on data from various public sources. Data have not been verified by the U.S. Geological Survey.
4/ Sites where extensive (+10,000 meters) drilling or significant (+$4 million) expenditure have been reported.

Source: Resource data reflect unverified public information reported by trade journals as reported in May 2002 Mining Engineering.

Digitized by Google

Digitized by Google

THE MINERAL INDUSTRY OF

ALGERIA

By Philip M. Mobbs

With an area of 2,381,741 square kilometers, this North African nation was the second largest country in Africa. About 80% of the country's area is desert; most of the population, which was estimated to be 31.7 million, lived in the northern coastal region (U.S. Central Intelligence Agency, 2002§[1]). The International Monetary Fund (2002§) estimated that the Algerian gross domestic product was $54.9 billion in 2001 compared with $53.3 billion in 2000.

Despite the drop in the average price of Algerian crude oil to $24.80 per barrel in 2001 from $28.70 per barrel in 2000, natural gas and petroleum continued to dominate the minerals sector (Banque d'Algerie, undated§). Of the nonfuel minerals produced, helium, iron ore, marble, mercury, and phosphate rock were the most notable.

In 2000 (the last year for which data were available) Algerian hydrocarbon exports (valued at $21.05 billion) accounted for 97% of the value of total exports, which were estimated to be $21.65 billion. Crude petroleum exports were valued at $4.8 billion; other exports included condensate (liquids at surface pressure and temperature that were recovered as coproducts of natural gas production), $4.0 billion; natural gas (by pipeline), $3.5 billion; liquified natural gas, $3.3 billion; refined petroleum products, $3.3 billion; and liquified petroleum gas, $2.1 billion (Callier, Abdallah, and Joly, 2001, p. 36). In 2001, Algeria ranked 11th on the list of countries from which the United States imported crude oil and petroleum products. Most of the imports were petroleum products, as Algeria only ranked 21st on the list of countries that supplied crude oil to the United States (U.S. Energy Information Administration, 2002).

The country's recent history of terrorist violence continued to affect adversely some international interest in the nation's mineral industry (U.S. Department of State, 2001§).

Government Policies and Programs

The evolution of the Algerian minerals sector continued in 2001 with the initial gold production from the Tirek Mine. On July 3, the Government published the new mining law (loi No. 01-10). A new electricity law was promulgated in 2001, and a new hydrocarbon law was being debated.

The Government proposed to manage the minerals sector through two organizations (the Agence Nationale du Patrimoine Minier and the Agence Nationale du Controle des Mines) created by the new mining law. In 2001, the state divested 70% of its interest in the El Hadjar steel and other associated operations of Société Algérienne de Fabrication Sidérurgique (ALFASID) and continued the reorganization of the state-owned oil and gas company Société Nationale pour la Recherche, la Production, le Transport, la Transformation, et la Commercialisation des Hydrocarbures (SONATRACH).

Although numerous mineral deposits had been identified by the Office National de la Recherche Géologique et Minière (ORGM), many were deemed to be uneconomic when discovered because they were located in remote areas that lacked infrastructure or the state mining enterprises to which the deposits were assigned were unable to secure Government funding for development (Ministère de l'Energie et des Mines, undated§). To promote the development of some of the small and medium mineral deposits, the Government held two additional divestment rounds during 2001 that offered domestic and international investors the opportunity to acquire mining titles to the deposits. By yearend, investors had acquired development or exploration permits on 132 properties. The state separately solicited bids for the rights to develop the Djebel-Aberraz diamond, the Tiririne-Hanane gold, and the Oued-Amizour lead-zinc deposits. Ten additional blocks were offered for petroleum exploration.

Structure of the Mineral Industry

Subsidiaries of the Ministère de l'Energie et des Mines (M.E.M.) remained involved in most mineral production. The Ministère de l'Industrie et de la Restructuration (M.I.R.) was responsible for the private and public construction material and mineral product sectors, which included brick, cement, glass, lime, steel, and refined zinc operations. International participation in the Algerian mineral industry was primarily by oil companies operating under contract in association with SONATRACH.

Government organizations involved in the mineral sector included the M.E.M.'s ORGM, which was responsible for geologic and mining research. National enterprises within the M.I.R. included the Entreprise des Ciments et Dérivés du Centre, the Entreprise des Ciments et Dérivés d'Ech, the Enterprise des Ciments et Derives de l'Est, the Entreprise des Ciments et Dérivés de l'Ouest, the Enterprise Nationale de Métallurgie et de Transformation des Métaux Non Ferreux (METANOF), and the Groupe Industriel Sider.

The mineral production section of the M.E.M. included the ASMIDAL group, the Entreprise d'Exploitation, Commercialisation et Exportation du Fer et du Phosphate s.p.a. (FERPHOS), the Enterprise Nationale d'Exploitation des Carrières de Sels Industriels et Domestiques et Commercialisation des Sels s.p.a., the Entreprise Nationale des Produits Miniers Non Ferreux & des Substances Utiles, s.p.a, and the Entreprise Nationale d'Extraction, Transformation, Production et Commercialisation du Marbre et de Dérivés de

[1]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

Marbre s.p.a. In addition to the M.E.M.'s national companies, more than 1,300 small private companies and local public enterprises were authorized to produce aggregates, clay, gypsum, marble, or salt.

The M.E.M.'s hydrocarbon branch included SONATRACH, Société Nationale de Raffinage de Pétrole-NAFTEC s.p.a. (NAFTEC), Société Nationale de Commercialisation et de Distribution de Produits Pétroliers-NAFTAL s.p.a., and Société Nationale de l'Electricité et du Gaz (SONELGAZ). SONATRACH subsidiaries included Cogiz s.p.a., which was the state's helium and nitrogen distribution company, and Helios s.p.a. In 2001, Algerian Energy Co. (a joint venture of SONATRACH and SONELGAZ) was created to handle exports of Algerian electricity.

Commodity Review

Metals

Gold.—The plant at the Tirek Mine, which was operated by Société d'Exploitation des Mines d'Or s.p.a., processed about 200 metric tons per day of ore to recover about 800 kilograms per year of gold (Mining Journal, 2002).

Steel.— LNM Holdings N.V. of the Netherlands Antilles acquired 70% equity interest in ALFASID; the Groupe Industriel Sider retained 30% interest. The new steel company was named Ispat Annaba s.p.a. Voest-Alpine Industrieanlagenbau GmbH & Co. of Austria continued work on the rehabilitation of the hot strip mill at Ispat Annaba's El Hadjar works that had been contracted for prior to the sale of the steelworks. LNM Holdings also acquired 70% equity interest in the Boukhrada and Ouenza iron ore mines from FERPHOS and renamed the new iron ore company Ispat Tebessa.

Zinc.—In March, Breakwater Resources Ltd. of Canada withdrew from its negotiations to acquire the Oued Amizour zinc project. The zinc development project was reoffered to domestic and international investors later in the year.

Mineral Fuels

SONATRACH reported that 37 exploration and 133 development wells were drilled in 2001, which resulted in 6 new hydrocarbon discoveries (3 oil and 3 condensate and natural gas wells). SONATRACH signed 10 new exploration and development contracts with foreign partners. The partners will be required to make minimum expenditures of $200 million to maintain the contracts (Société Nationale pour la Recherche, la Production, le Transport, la Transformation, et la Commercialisation des Hydrocarbures, 2002§).

NAFTEC solicited bids for the rehabilitation of the 75,000-barrel-per-day-capacity In Anemas refinery that had closed in 1986 and for the construction of an additional crude oil refinery in the Adrar region (Africa Energy Intelligence, 2001).

The Government planned to increase natural gas exports to 85 billion cubic meters per year by 2005 compared with estimated exports of 62 billion cubic meters in 2000 (Petroleum Economist, 2002). In 2001, work on the $2.7 billion development of the In Salah gasfields continued. British Petroleum plc, which was paying 65% of the development costs, and SONATRACH (35%) proposed to produce 9 billion cubic meters per year from the Garat el-Bafinat, Gour Mahmoud, Hassi Moumene, In Salah, Krechba, Reg, and Teguentour Fields. Initial production was scheduled for mid-2004 (Middle East Economic Digest, 2001b).

A 27-month, $93 million contract to expand the capacity of the Pedro Duran Farell pipeline (which was formerly known as the Maghreb-Europe pipeline) to 11 billion cubic meters per year from 8 billion cubic meter per year was awarded to ABB Group of Switzerland (Middle East Economic Digest, 2001a). Studies of the proposed Medgaz gas pipeline from Algeria to Spain progressed during 2001, and a feasibility study for electricity exports to Spain was begun. A $5 billion to $7 billion, 4,000-kilometer (km) gas pipeline was proposed to be built from Nigeria to Algeria to facilitate export of Nigerian gas to Europe (Oil & Gas Journal, 2001). At yearend, a feasibility study on a second natural gas pipeline from Algeria to Italy was initiated.

Additional information on the energy situation in Algeria is available from the U.S. Department of Energy Web site at URL http://www.eia.doe.gov/emeu/cabs/algeria.html.

Infrastructure

SONELGAZ had an installed electricity generating capacity of 5,922 megawatts (Richards, 2001). Thermal plants (diesel, natural gas, and oil fired) accounted for about 99.8% of the electricity generated. Algeria's railroad system, which totaled 4,060 km of track, and its road network, which covered more than 90,000 km, primarily served the northern section of the country and supported long-established mining and other export-oriented industries.

With the closure of the GK2 gas pipeline from Hassi R'Mel to Skikda, about 12,700 km of pipeline served the hydrocarbon industries within Algeria. Three crude oil pipelines ran north to Skikda, Bejaia, and Arzew from Hassi Messaoud in the southeast. The focus of the natural gas pipeline network was Hassi R'Mel, from which pipelines were connected to liquefaction facilities at Arzew and Skikda. Hassi R'Mel also was the gathering point for natural gas exports to southern Europe by means of the 24-billion-cubic-meter-per-year-capacity 2,340-km Enrico Mattei pipeline (which was formerly the Trans-Mediterranean or Transmed pipeline) that extended from Algeria northeastward through Tunisia and under the Mediterranean Sea to Sicily and the Italian mainland and by the 1,845-km Pedro Duran Farell pipeline that traversed northwestwards through Algeria and across Morocco and the Straits of Gibraltar to Spain (ENI S.p.A., 2000§).

Outlook

Owing to its location close to Europe (which was the major market for its minerals), its known undeveloped and inferred hydrocarbon deposits, its functional infrastructure, and the

Digitized by Google

opening of the mineral industry to foreign investment, Algeria is expected to be of increased interest to international companies. Occurrences of base and precious metals and industrial minerals in Algeria could entice international mineral exploration and development organizations to evaluate their development potential. The Government's interest in reducing the mineral economy's dependence on oil and gas could add incentives to the nonfuel mineral sector. Recurrent guerilla activity remained a deterrent to investors (Drummond, 2001; Mining Journal, 2000).

References Cited

Africa Energy Intelligence, 2001, Algerians seek to get In Anemas refinery back in service: Africa Energy Intelligence, no. 301, June 20, p. 7.

Callier, Philippe, Abdallah, Khanjar, and Joly, Hervé, 2001, Algeria—Statistical appendix: Washington, DC, International Monetary Fund Country Report No. 01/63, August 3, 49 p.

Drummond, James, 2001, Violence spreads across Algeria: Financial Times [London, United Kingdom], June 18, p. 6.

Middle East Economic Digest, 2001a, ABB scores again: Middle East Economic Digest, v. 45, no. 34, August 24, p. 11.

Middle East Economic Digest, 2001b, In Salah in business: Middle East Economic Digest, v. 45, no. 34, August 24, p. 10.

Mining Journal, 2000, Algeria ready for business: Mining Journal, v. 334, no. 8576, March 31, p. 244.

Mining Journal, 2002, Algeria's first gold mine: Mining Journal, v. 338, no. 8674, March 1, p. 166.

Oil & Gas Journal, 2001, Quick takes: Oil & Gas Journal, v. 99, no. 38, September 17, p. 8.

Petroleum Economist, 2002, Algerian gas exports set for sharp rise: Petroleum Economist, v. 69, no. 3, March, p. 4.

Richards, Catherine, 2001, About change: Middle East Economic Digest, v. 45, no. 7, February 16, p. 4-5.

U.S. Energy Information Administration, 2002, Table S3—Crude oil and petroleum product imports—1986-present: Petroleum Supply Monthly, August, p. 8-15.

Internet References Cited

Banque d'Algerie, [undated], Tendances monetaires et financieres au second semestre 2001, accessed September 17, 2002, at URL http://www.bank-of-algeria.dz/notes1.htm.

ENI S.p.A., 2000 (November 9), ENI—25 years of gas imports from Algeria—Renewed collaboration to carry out new hydrocarbon exploration and production activities, accessed September 22, 2002, at URL http://www.eni.it/ english/notizie/comunicati/comunicati00/cs_09_11.html.

International Monetary Fund, 2002 (April), Gross domestic product—Current prices—All countries, World Economic Outlook Database, accessed September 21, 2002, at URL http://www.imf.org/external/pubs/ft/weo/2002/01/data/ngdpd_a.csv.

Ministère de l'Energie et des Mines, [undated], Opportunités d'invéstissements—Mines, accessed August 14, 2001, at URL http://www.mem-algeria.org/opportunites/opport_mines.htm.

Société Nationale pour la Recherche, la Production, le Transport, la Transformation, et la Commercialisation des Hydrocarbures, 2002, [untitled], accessed September 17, 2002, at URL http://www.sonatrach-dz.com/result2001pdg.htm.

U.S. Central Intelligence Agency, 2002, Algeria, World Factbook, accessed September 23, 2002, at URL http://www.odci.gov/cia/publications/factbook/geos/ag.html.

U.S. Department of State, 2001 (December 11), Algeria—Travel warning, accessed September 21, 2002, at URL http://travel.state.gov/algeria_warning.html.

Major Sources of Information

Ministère de l'Energie et des Mines
80 Avenue Ahmed Ghermoul
Algiers, Algeria
Telephone: +(213-21) 67 33 00
Telecopier: +(213-21) 67 03 66

Ministère de l'Industrie et de la Restructuration
Immeuble Le Colisee, 3
Rue Ahmed Bey
Algiers, Algeria
Telephone: +(213-21) 23-90-33
Telecopier: +(213-21) 23-94-88
E-mail: info@mir-algeria.org

Office de la Recherche Géologique et Minière
Cité Ibn Khaldoun
B.P. 102
Boumerdès, 35000, Algeria
Telephone: +(213-24) 81 85 25
Telecopier: +(213-24) 81 83 79
E-mail: orgm@wissal.dz

Société Nationale pour la Recherche, la Production, le Transport, la Transformation, et la Commercialisation des Hydrocarbures (SONATRACH)
Djenane El Malik - Hydra
Algiers, Algeria
Telephone: +(213-21) 54 80 11
Telecopier: +(213-21) 54 77 00
E-mail: sonatrach@sonatrach-dz.com

Digitized by Google

TABLE 1
ALGERIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/ 3/		1997	1998	1999	2000	2001 e/
METALS						
Cadmium, refined e/		75	70	10 r/	10 r/	10
Gold	kilograms	--	--	--	--	300
Iron and steel:						
Iron ore, gross weight	thousand tons	1,637	1,783	1,336	1,645	1,500
Metal:						
Pig iron e/	do.	700	700	500	400	400
Steel, crude	do.	427	400 e/	758	842	850
Lead:						
Concentrate, Pb content		845	730	1,215	818	900
Metal, refined e/		8,000	7,000	5,700 r/	6,100 r/	6,000
Mercury	kilograms	447,034	223,965	240,327	215,625	220,000
Silver e/	do.	1,600	1,500	1,400	1,400	1,700
Zinc:						
Concentrate, Zn content		3,690	4,555	9,808	10,452	12,000
Metal, smelter output e/		29,300	31,000	32,200 r/	34,000	34,000
INDUSTRIAL MINERALS						
Barite, crude		39,140	37,006	50,510	51,925	52,000
Cement, hydraulic 4/	thousand tons	7,000	7,500	7,500 e/	8,300 e/	8,300
Clays:						
Bentonite		17,657	15,655	15,491	22,708	21,286 5/
Fuller's earth		3,960	3,942	2,489	3,431	3,500
Kaolin		18,533	13,640	16,833	11,616	11,500
Diatomite		2,332	2,133	2,563	2,500 e/	2,500
Feldspar e/		7,000	7,000	2,820 5/	707 5/	--
Gypsum e/ 6/	thousand tons	275	275	1,316 5/	1,341 5/	1,350
Helium, liquid e/	million cubic meters	15	16	16 5/	10	17
Lime, hydraulic e/		65,000	65,000	76,000	96,000	100,000
Marble		702,000	732,000	665,000 e/	700,000 e/	700,000
Nitrogen, N content of ammonia 7/		379,400	350,200	455,400	457,900 r/	458,000
Phosphate rock:						
Gross weight	thousand tons	1,063	1,155	1,096	877	900
P_2O_5 content e/	do.	330	358	340	265	280
Salt, brine and sea salt		137,317	172,025	163,748	182,000	185,000
Sulfur, elemental e/		23,000	23,000	25,000	25,000	25,000
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	125,012	125,971	128,783	139,499	140,000
Dry 8/	do.	97,458	96,873	97,151	100,092	105,000
Natural gas plant liquids	thousand 42-gallon barrels	69,000	77,200	85,411	95,619	95,000
Petroleum:						
Crude including condensate	do.	466,105	454,750	457,158	476,288	475,000
Refinery products:						
Liquefied petroleum gas	do.	6,200 e/	6,100 e/	6,191	6,322	6,000
Gasoline	do.	17,313	17,836	20,310	17,964	17,500
Naphtha	do.	33,233	31,688	32,757	32,124	32,000
Kerosene and jet fuel e/	do.	8,000	8,000	10,428 5/	12,458 5/	12,500
Distillate fuel oil	do.	48,661	46,245	48,132	44,820	44,500
Lubricants	do.	686	728	777	770	750
Residual fuel oil	do.	37,002	33,753	37,842	36,803	36,000
Other e/	do.	2,500	2,000	2,884 5/	3,044 5/	2,500
Total	do.	154,000 e/	146,000 e/	159,321	154,305	152,000

e/ Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. r/ Revised. -- Zero.

1/ Table includes data available through September 20, 2002.

2/ In addition to the commodities listed, secondary aluminum, coke, secondary lead, and secondary copper may be produced in small quantities, and crude construction materials are produced for local consumption, but output is not reported and available information is inadequate to make estimates of production levels.

3/ In addition to the commodities listed, about 700 metric tons per year of caustic soda had been estimated to be produced.

4/ Erroneous cement units (metric tons instead of thousand tons) were used in previous Algeria production tables published during the the period 1997 to 2000.

5/ Reported figure.

6/ Includes about 50,000 metric tons per year of plaster.

7/ Additional nitrogen was produced by Helios s.p.a., the helium liquids production company. In 1999, the last year for which data are available, Helios produced more than 68,000 42-gallon barrels of liquid nitrogen and 14 million cubic meters of gaseous nitrogen.

8/ Excludes gas used in reinjection, flaring, venting, and transmission losses.

Digitized by Google

TABLE 2
ALGERIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2001

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Ammonia	Le Groupe ASMIDAL	Alzofert Plant, Arzew	660,000
Do.	do.	Fertial Plant, Annaba	330,000
Bentonite	Entreprise Nationale des Produits Miniers Non Ferreux & des Substances Utiles, s.p.a.	Boughara, Maghnia, M'Zila, and Salah Bouchaour	NA
Cadmium	Société Algérienne du Zinc (Enterprise Nationale de Métallurgie et de Transformation des Métaux Non Ferreux, 100%)	Ghazaouet	200
Cement	Société des Ciments d'Aïn-Touta (Enterprise des Ciments et Derives de l'Est, 100%)	Aïn Touta	1,000,000
Do.	Société des Ciments d'Aïn-Kébira (Enterprise des Ciments et Derives de l'Est, 100%)	Aïn-Kébira	1,000,000
Do.	Société des Ciments de Hamma-Bouziane (Enterprise des Ciments et Derives de l'Est, 100%)	Hamma-Bouziane	1,000,000
Do.	Société des Ciments de Hadjar Soud (Enterprise des Ciments et Derives de l'Est, 100%)	Bekkouche	900,000
Do.	Société des Ciments de Tébessa (Enterprise des Ciments et Derives de l'Est, 100%)	Tébessa	525,000
Do.	Entreprise des Ciments et Dérivés du Centre	Meftah	1,000,000
Do.	do.	Sour-El-Ghoziane	1,000,000
Do.	do.	Raïs-Hamidou	400,000
Do.	Entreprise des Ciments et Dérivés d'Ech	Chlef	2,000,000
Do.	Entreprise des Ciments et Dérivés de l'Ouest	Zahana	1,200,000
Do.	do.	Beni-Saf	1,000,000
Do.	do.	Saïda	500,000
Coke	Ispat Annaba s.p.a. 1/ (LNM Holdings N.V., 70%)	El Hadjar	1,200,000
Copper, cathode	Société Algérienne du Zinc (Enterprise Nationale de Métallurgie et de Transformation des Métaux Non Ferreux, s.p.a., 100%)	Ghazaouet	NA
Diatomite	Entreprise Nationale des Produits Miniers Non Ferreux & des Substances Utiles, s.p.a.	Mascara	3,000
Fertilizers			
Nitrogen	Le groupe ASMIDAL	Alzofert Plant, Arzew	495,000
Do.	do.	Fertial Plant, Annaba	330,000
Phosphatic 2/	do.	Fertial Plant, Annaba	915,000
Gold, mine output kilograms	Société d'Exploitation des Mines d'Or s.p.a. (Société Nationale du Pétrol et Gaz, 34.12%; Banque d'Algerie, 33.78%; Société Nationale d'Assurance, 17.57%; Entreprise Nationale des Produits Miniers Non Ferreux & des Substances Utiles, s.p.a., 10%)	Tirek	800
Gypsum	Unité Chaux de Chettaba (Société des Produits Dérivés de l'Est, 100%)	Chettaba	200,000
Iron ore	Ispat Tebessa 3/ (LNM Holdings N.V., 70%)	Boukhrada	1,000,000
Do.	do.	Ouenza	3,600,000
Helium	Helios s.p.a. (Sonatrach Valorisation Hydrocarbons, 51%)	GI2Z complex, Arzew	NA
Liquefield natural gas million cubic meters	Société Nationale pour la Recherche, la Production, le Transport, la Transformation et la Commercialisation des Hydrocarbures	GL2Z complex, Bethioua	17.8 4/
Do. do.	do.	GL1Z complex, Bethioua	17.5 4/
Do. do.	do.	GL1K complex, Skikda	11.2 4/
Do. do.	do.	GL4Z complex, Arzew	2.0 4/
Liquefied petroleum gas (LPG) and natural gas liquids 5/ barrels	do.	GP1Z complex, Arzew	500,000
Do. do.	do.	LPG separation unit, Hassi R'Mel	330,000
Do. do.	do.	LPG separation unit, Rhourde Nouss	122,000
Do. do.	do.	LPG separation unit, Adrar	92,000
Do. do.	do.	GP2Z complex, Arzew	110,000
Do. do.	do.	GL1K complex, Skikda	84,000
Do. do.	do.	GL2Z complex, Bethioua	84,000
Do. do.	do.	GL1Z complex, Bethioua	13,000
Do. do.	do.	GL4Z complex, Arzew	2,000
Do. do.	Société Nationale de Raffinage de Pétrole NAFTEC s.p.a.	RA1K refinery, Skikda	3,600
Lime	E.R.C.O. (Société des Produits Dérivés de l'Ouest, 100%)	NA	100,000
Do.	Unité Chaux de Chettaba (Société des Produits Dérivés de l'Est, 100%)	Chettaba	8,100
Marble	Entreprise Nationale d'Extraction, Transformation, Production et Commercialisation du Marbre et de Dérivés de Marbre s.p.a.	Quarries at Bensekrane, Filfila, Ghazaouet, and Oum El Assel	NA

See footnotes at end of table.

Digitized by Google

TABLE 2--Continued
ALGERIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2001

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Marble--Continued:		Entreprise Nationale d'Extraction, Transformation, Production et Commercialisation du Marbre et de Dérivés de Marbre s.p.a.	Processing plants at Guelma, Oran, Sig, and Skikda	NA
Mercury	kilograms	Entreprise Nationale des Produits Miniers Non Ferreux & des Substances Utiles, s.p.a.	Ismail and M'Rasma Mines, near Azzaba	450,000
Methanol		ENIP s.p.a. (Holding SONATRACH Raffinage et Chimie des Hydrocarbures, 100%)	Methanol plant, Arzew	100,000
Natural gas	million cubic meters	Société Nationale pour la Recherche, la Production, le Transport, la Transformation et la Commercialisation des Hydrocarbures	Numerous gasfields, including Adrar, Hamra, Hassi R'Mel, and Sbaa	86,000
Do.	do.	TFT Grouping	Tin Fouye Tabankort Field	7,300
Petroleum, crude	42-gallon barrels per day	Société Nationale pour la Recherche, la Production, le Transport, la Transformation et la Commercialisation des Hydrocarbures	About 50 oilfields, including Acheb West, Amassak/Tin-Yaguene, Draa Tamra, Edjeleh, El Borma, El Gassi, Gassi-Touil East, Guellala, Hassi Messaoud North and South, Ohanet North, Rhourde El Baguel, Tin-Fouye, and Zarzaitine	780,000
Petroleum products	do.	Société Nationale de Raffinage de Pétrole-NAFTEC s.p.a.	RA1K refinery, Skikda	300,000
Do.	do.	do.	RA1G refinery, Algers	60,000
Do.	do.	do.	RA1Z refinery, Arzew	60,000
Do.	do.	Société Nationale pour la Recherche, la Production, le Transport, la Transformation et la Commercialisation des Hydrocarbures, Sonatrach	RHM refinery, Hassi-Messaoud	30,000
Phosphate rock		Entreprise de'Exploitation, Commercialisation et Exportation du Fer at du Phosphate s.p.a.	Djebel Onk	700,000
Salt, refined		Enterprise Nationale d'Exploitation des Carrières de Sels Industriels et Domestiques et Commercialisation des Sels s.p.a.	El Outaya refinery, Biskra	50,000
Salt, rock		do.	El Outaya, Biskra	NA
Salt, solar		do.	Béthioua, Oran; El Méghaïer, El Oued, Guergour Lamri, Sétif Ouled Zouaï, Oum el Bouaghi, and Sidi Bouziane, Relizane	300,000
Steel		Ispat Annaba s.p.a. 1/ (LNM Holdings N.V., 70%; and Groupe Industriel Sider 30%)	Blast furnaces at El Hadjar, Annaba	1,400,000
Do.		do.	Electric arc furnace at El Hadjar, Annaba	400,000
Do.		do.	Hot strip mill at El Hadjar, Annaba	1,320,000
Do.		do.	Cold rolling mill at El Hadjar, Annaba	700,000
Do.		do.	Bar and wire rod mill at El Hadjar, Annaba	540,000
Do.		do.	Seamless tube mill at El Hadjar, Annaba	100,000
Do.		Entreprise Nationale de Tubes et de Transformation de Produits Plats (Groupe Industriel Sider, 100%)	Welded tube plant at Ghardaia	128,000
Do.		Société Algérienne de Fabrication Tubes en Spirale (Groupe Industriel Sider, 100%)	Welded tube plant at El Hadjar, Annaba	70,000
Sulfuric acid		Société Algérienne du Zinc (Enterprise Nationale de Métallurgie et de Transformation des Métaux Non Ferreux, 100%)	Ghazaouet	70,000
Urea		Fertalge s.p.a.	Arzew	360,000 6/
Zinc, metal		Société Algérienne du Zinc (Enterprise Nationale de Métallurgie et de Transformation des Métaux Non Ferreux, 100%)	Ghazaouet	30,000

NA Not available.
1/ Prior to the October 1 partial privitization of the Government's interest, the company was known as Groupe Industriel Sider (ALFASID).
2/ Capacity includes 550,000 metric tons per year compound fertilizer [nitrogen, phosphorus, and potassium (NPK) or phosphorus and potassium (PK)] or tripple superphosphate (TSP), and 365,000 t/yr single superphosphate (SSP).
3/ Prior to the partial privitization of the Government's interest, the company was wholly owned by the Entreprise de'Exploitation, Commercialisation et Exportation du Fer et du Phosphate.
4/ One cubic meter of liquified natural gas is equivalent to 584 cubic meters of natural gas. Natural-gas-equivalent capacities (in billions of cubic meters) were GL2Z--10.4, GL1Z--10.2, GL1K--6.5, and GL4Z--1.1.
5/ Output includes butane, isobutane, natural gasoline, and propane.
6/ Under construction.

Digitized by Google

THE MINERAL INDUSTRY OF

ANGOLA

By George J. Coakley

The Republic of Angola had a population of more than 12 million in a 1,246,700-square-kilometer (km^2) area. The area includes Cabinda, a coastal strip 100 kilometers (km) wide and 150 km long, located between the Republic of the Congo [Congo (Brazzaville)] and the Democratic Republic of the Congo [Congo (Kinshasa)]. The mineral economy of Angola was dominated by petroleum with diamond being another important source of revenues. According to the Banco Nacional de Angola (2002a§[1], b§), the country had a favorable merchandise trade balance of payments in 2001 of $3.35 billion, which was based on export values of $6.53 billion, of which crude and refined petroleum product exports accounted for $5.80 billion and merchandise imports, $3.18 billion. By comparison, in 2000, Angola exported $6.95 billion of crude petroleum, $132 million of refined petroleum products, $37 million of natural gas, and $739 million of diamonds. The drop in export value of crude petroleum was attributed primarily to the lower average price per barrel of oil as Angola exported 256.1 million barrels of oil in 2000 at an average price of $27.10 compared with 250.73 million barrels in 2001 at an average price of $22.69 per barrel.

Events in early 2002 suggested a major turning point in the political and economic future for Angola. In January, the leader of the National Union of the Total Independence of Angola (UNITA) rebel movement was killed, and in April, a cease-fire agreement was signed between the Government and UNITA, which apparently brought an end to the nation's long civil war. During the 27-year conflict, about 1 million people were killed; tens of thousands were maimed, chiefly from land mines; more than 4 million people were displaced; and the country was left with a massive debt. The country was spending approximately one-third of its annual GDP to service its foreign debt estimated in 2000 to be around $11 billion, which was one of the highest in Africa (African Forum & Network on Debt & Development, undated§). Inflation also remained a problem, although inflation decreased to 116% in 2001 from 268% in 2000.

The redevelopment of Angola will be based on development of its rich offshore petroleum endowment and to a lesser extent by reopening access to its land-based diamond resources to new foreign investment. The highlight of the mineral industry in Angola for 2001 continued to be the success of offshore deepwater petroleum exploration programs. Protected from the onshore civil war actions, the major consortiums holding oil-production-sharing agreements with the State-owned Sociedade Nacional de Combustiveis de Angola (Sonangol), which were led by BPAmoco, ChevronTexaco Corp., ExxonMobil Angola Ltd., and TotalFinaElf, reported 34 significant new deepwater oil discoveries, which included 4 during 2001, between 1996 and 2001 (table 2). Historically, nearly two-thirds of oil production came from ChevronTexaco's block 0, new deepwater discoveries in blocks 14, 15, 17, and 18 however, will significantly expand production. During 2001, ChevronTexaco's Kuito Field in Block 14 and TotalFinaElf's large Girassol Field in block 17 came onstream, which will add about 285,000 barrels per day (bbl/d) of new production.

This successful exploration has increased national reserves to an estimated 12 billion barrels of oil and 270 billion cubic meters of natural gas. Between 2002 and 2007, an estimated $20 billion is scheduled for investment in developing these petroleum resources; Angola has been projected to surpass Libya as the second largest oil producer in Africa after Nigeria. Petroleum production was expected to increase from 730,000 bbl/d in 2001 to 1.5 million bbl/d by 2005 to 1.7 million bbl/d by 2007 and from 1.9 million to 2.0 million bbl/d by 2010. Investment plans include construction of a new $2 billion liquified natural gas (LNG) plant in Luanda by 2006; the plant was expected to process 4 million metric tons (5.5 billion cubic meters) per year (Mt/yr) of captured natural gas (Aremu, 2001§; Embassy of Angola, Washington, DC, 2002§).

Despite the ongoing civil war and United Nations sanctions against illegally mined diamonds, officially reported diamond production in 2001 increased by 19% to 5.17 million carats of diamond. According to the United Nations Security Council (2001§), 69% of diamond under Government control in 2000 came from nine official mines, and 31% was attributed to artisanal miners. The value of production was reported to be $398.5 million for the official sector and $347.6 million for the unofficial diamond sector. Diamond smuggling by UNITA and other sources was estimated to have increased to $250 million in 2000. The United Nations estimated that the total value of diamond mining, which included production from UNITA-controlled mines, was a minimum of $1.1 billion. The April 2001 United Nations report also concluded "that the increase in non-UNITA smuggling during 2000 meant that illicit Angolan diamonds are still reaching diamond markets regardless of the certificate of origin system and which makes the tracing of UNITA smuggling more problematic." The United Nations report explained the operations of the Angola Selling Corp. (ASCorp), which was a governmental single-channel marketing system designed to regulate diamond buying; the efforts to train and regulate the estimated 100,000 artisanal miners working in Angola; the operations of the Guichet Unico, which was established to investigate applicants for diamond credentials and to issue credentials; and the illicit diamond trading and smuggling operations.

In 2001, Sociedade Miniera de Catoca Ltda. (SMC) remained the largest producer with output of around 1.5 million carats from

[1]References that include a section twist (§) are found in the Internet References section.

Digitized by Google

its Catoca kimberlite pipe, which is located 35 km south of Saurimo. SMC was a joint venture of Empresa Nacional de Diamantes de Angola (Endiama) (32.8%), Russia's Almazy Rossii-Sakha (32.8%), Brazil's Odebrecht Mining Services Inc. (18.4%), and Israel's Lev Leviev (16%). Between the beginning of exploration in 1997 and the end of 2001, SMC mined 9.7 million metric tons (Mt) of ore and recovered 7.5 million carats of diamonds. Diamond sales during this period totaled 7.3 million carats at an average value of $72 per carat. SMC planned to invest more than $50 million between 2002 and 2005 to increase production capacity to 7 Mt/yr of ore that would yield 4,826,000 carats per year (Sociedade Miniera de Catoca Ltda., 2002a§). Estimates of reserves in the Catoca kimberlite were reported to be 271 Mt of ore that contains 189.3 million carats of diamond (Sociedade Miniera de Catoca Ltda., 2002b§).

Sociedade de Desenvolvimento Mineiro de Angola, S.A.R.L. (SDM), which was a joint venture of Ashton Mining Ltd. of Australia, Endiama, and Odebrecht, was formed in 1995 to mine alluvial diamond in the 85,600-km^2 Cuango River Valley concession, which is centered near the town of Luzamba in northeastern Angola. The operations included the Tázua alluvial mine and a final recovery plant at Luzamba. Despite ongoing security problems and related intermittent work suspensions during the past 2 years, SDM was able to produce 419,000 carats of high-quality diamonds in 2001. Bulk sampling of river terrace gravels in the vicinity of the Ganzo, the Ginge, and the Tázua River diversions have revealed economic diamond grades (MBendi Information Services (Pty) Ltd., 2002§).

DiamondWorks Ltd. of Canada held a majority interest in the Luo and the Yetwene alluvial diamond projects, which have been on care and maintenance since November 1999. DiamondWorks also held mining rights to five kimberlite pipes, which included the large Camatchia Pipe and the Camagico pipe. DiamondWorks underwent a financial and management restructuring in 2001 and was positioned to consider reopening its operations during 2002.

By yearend 2001, negotiations on finalizing the terms of the proposed Camafuca kimberlite joint venture and obtaining approval of the mining permit from the Government were ongoing between SouthernEra Resources Ltd. of Canada and its Angolan joint-venture stakeholders. The joint venture will be incorporated as the Sociedade Mineira do Camafuca, Lda.; ownership will be split among Welox Limited, which was a member of the Leviev Group of Companies (33%), SouthernEra (32%), and Endiama (20%), and Sociedade Mineira do Lucapa Limitada (SML), which was an affiliate of Endiama (15%). Welox had agreed to provide $20 million of the financing for the first phase of the dredge-mining project. The Phase I feasibility study on the Camafuca-Camazamba kimberlite facies, which was completed by SouthernEra in 2001, reported total resources at Camafuca to a depth of 145 meters estimated to be 209.5 million cubic meters at an average grade of 0.111 carats per cubic meter and to contain 23.24 million carats of diamond valued at $109 per carat. The initial 5-year-long Phase I project will remove 6.13 million cubic meters of dredged material that contains an average grade of 0.18 carat per cubic meter, which would yield 220,000 carats per year valued at $117 per carat. Dredged material will move by a slurry pipeline to a land-based conventional dense-media separation plant. Estimated capital cost of the project was $25 million (SouthernEra Resources Ltd., 2002§).

The joint venture between SML (51%) and Sociedade Portuguese de Empreendimentos (49%) operated several alluvial projects in Lunda Norte and Lunda Sud Provinces in 2001 and held exploration rights over a 35,000-km^2 area. Diamond production during 2001 included 244,000 carats from the Mufuto project, 199,000 carats from the Calonda project, and 69,000 carats from the Lucapa project. Associacao Chitotolo, which was an alluvial diamond company owned by Sociedade Miniera de Lumanhe (50%), ITM Mining Ltd. (35%), and Endiama (15%), produced 232,000 carats of alluvial diamond in 2000 (Mbendi Information Services, 2002§).

During 2000, the joint venture between De Beers Angola Prospecting Ltd., which was a wholly owned subsidiary of De Beers Consolidated Mines Ltd., and Endiama announced the discovery of 17 new kimberlites in its concession areas in Lunda Norte and Lunda Sul Provinces. Exploration was suspended in May 2001 pending negotiations between De Beers and the Angolan Ministry of Mines and Geology on the terms applicable to mining and marketing of diamond from mines discovered as a result of prospecting by De Beers (De Beers S.A., 2002§).

International Defense and Security Forces Resources NV (IDAS) of the Netherlands Antilles (a wholly owned subsidiary of American Mineral Fields, Inc., of Canada) held the Cuango International area prospecting license and the Luremo Mining license in the Cuango Valley. IDAS had only limited access to the UNITA-controlled areas during 2000. During 2001, the company significantly reduced its operating presence in Angola and concentrated on negotiating the security of its license areas and on a new operating agreement or model final contract with Endiama, which governed the management, ownership, and expenditure commitments for the licences. In October 2001, IDAS was awarded two new licenses in Lunda Norte and Malange Provinces that covered a 2,690-km^2 area along the Cuanga River flood plain up to the border between Angola and Congo (Kinshasa) and an adjoining license to the south that covered 246 km^2 situated to the north of Cafunfo (American Mineral Fields, Inc., 2001).

Other companies involved with diamond exploration included Botswana Diamondfields Inc. (a subsidiary of Crew Development of Canada) AmCan Minerals Ltd. of Canada, Randsburg International Gold Corp. of Canada, Trans Atlantic Enterprises Inc. of Canada, Majestic Resources of Australia, and Petra Diamonds Ltd. of South Africa.

For more-extensive coverage of the mineral industry of Angola, see the 2000 Minerals Yearbook, volume III, Mineral Industries of Africa and the Middle East.

Reference Cited

American Mineral Fields, Inc., 2001, American Mineral Fields awarded Angolan diamond licenses: London, United Kingdom, American Mineral Fields, Inc., press release, October 3, 1 p.

Internet References Cited

African Forum & Network on Debt & Development, [undated], Debt profiles—Angola, accessed January 7, 2003, at URL http://www.afrodad.org/html/Debt/angola.htm.

Digitized by Google

Aremu, Moses, 2001 (September 22), Angola—Deepwater developments blooming, Oil and Gas International, accessed December 7, 2002, at URL http://www.oilandgasinternational.com/departments/special_features/angola.html.
Banco Nacional de Angola, 2002a, 1994-2001—Balança global, Indicadores Macro-económicos—Angola—Balança de Pagamentos, accessed January 7, 2002, at URL http://www.bna.ebonet.net//bna_bp6-7.htm.
Banco Nacional de Angola, 2002b, 1994-2001—Composição das exportações, Indicadores Macro-económicos—Angola—Balança de Pagamentos, accessed January 7, 2002, at URL http://www.bna.ebonet.net//expint.htm.
De Beers S.A., 2002, Exploration—Global activities—Angola, accessed November 22, 2002, at URL http://www.debeersgroup.com/exploration/expGloActAngola.asp.
Embassy of Angola, Washington, DC, 2002, Angola poised to become Africa's second largest oil producer, O Pensador, March/April, Economic Notes, accessed December 12, 2002, at URL http://www.angola.org/news/pensador/index.html.
MBendi Information Services (Pty) Ltd., 2002 (October 30), Angloa—Mining—Diamond mining, accessed December 15, 2002, at URL http://mbendi.co.za/indy/ming/dmnd/af/an/p0005.htm.
Sociedade Miniera de Catoca Ltda., 2002a, Catoca—Informações econômicas e financeiras and Ações estartégicas, accessed January 22, 2003, at URL http://www.catoca.com.
Sociedade Miniera de Catoca Ltda., 2002b§, Catoca—Geologia, accessed January 22, 2003, at URL http://www.catoca.com.
SouthernEra Resources Ltd., 2002 (April 20), Annual report for 2001, accessed January 9, 2003, at URL http://www.southernera.com/SUFannual2001.pdf.
United Nations Security Council, 2001 (April 18), Addendum to the final report of the monitoring mechanism on sanctions against UNITA, Report No. S/2001/363, accessed July 15, 2001, at URL http://www.un.org/Depts/dhl/docs/s2001363.pdf.

Major Sources of Information

Angolan Mining Association
Rua Cte Nzaji 7
Luanda, Angola
Tel: (244-2) 320-656

Empresa Nacionale de Diamantes de Angola (Endiama)
Av. Major Kanhangulo N.o 100
Caixa Postal 1247
Luanda, Angola
Telephone: (244-2) 337-276
Fax: (244-2) 330-377
E-Mail: endiama@endiama-angola.com
Internet: http://endiama-angola.com

Ministry of Geology and Mines (Ministério de Geologia e Minas)
Avenida Comandante Gika
Caixa Postal 1260
Luanda, Angola
Telephone: (244-2) 326-724 or 322-766
Fax: (244-2) 321-655 or 322-569

Ministry of Petroleum (Minesterio dos Petroleos)
Avenida 4 de Fevereiro
Luanda, Angola
Tel: (244-2) 337-448/492/493
Fax: (244-2) 335-381

Sonangol Holding (Sociedade Nacional de Combustiveis de Angola)
Rua 1° Congresso do MPLA, N.° 8-16
Caixa Postal 1316
Luanda, Angola
Telephone: (244-2) 334-448 or 331-690
Fax: (244-2) 391-782
Telex: 2089 SONANG AN
E-mail: secretariageral@sonangol.co.ao
Internet: http://www.sonangol.co.ao

TABLE 1
ANGOLA: PRODUCTION OF MINERAL COMMODITIES 1/

Commodity		1997	1999	1999	2000	2001
INDUSTRIAL MINERALS						
Cement, hydraulic	thousand metric tons	301 2/	350 2/	350 e/	350 e/	350 e/
Diamond 3/ 4/	thousand carats	1,234 2/	2,764 2/	3,806 2/	4,313 2/	5,159 2/
Granite e/	thousand cubic meters	1,500	1,500	1,500	1,500	1,500
Marble e/	do.	100	100	100	100	100
Salt e/	metric tons	30,000	30,000	30,000	30,000	30,000
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross 6/	million cubic meters	5,804 2/	5,804 2/	5,800	11,613 2/	11,027 2/
Dry	do.	566 2/	566 2/	560	560 2/	574 2/
Liquified petroleum gas	thousand 42-gallon barrels	1,643 2/	1,292 2/	1,290 r/	1,300 2/	1,300 2/
Petroleum:						
Crude	thousand 42-gallon barrels	262,800 2/	268,275 2/	279,590	273,020 2/	270,100 2/
Refinery products 5/	do.	11,700	13,180 2/	14,000	14,000	14,000

e/ Estimated; estimated data are rounded to no more than three significant digits. r/ Revised.
1/ Includes data available through November 2002.
2/ Reported figure.
3/ Exports; does not include smuggled production.
4/ Production was approximately 90% gem and 10% industrial grade.
5/ Included asphalt and bitumen.
6/ Angola has no natural gas distribution system. Most gas was vented and flared.

Digitized by Google

TABLE 2
ANGOLA: OIL AND GAS DISCOVERIES AND PROPOSED INVESTMENT, 1996-2011 1/

Operating Company	Development	Commodity	Capacity	Investment (million dollars)	Startup date	Comments, reserves etc.
ChevronTexaco Corp. 2/	Block 0 - Cabinda	Petroleum	100,000 to 600,000 bbl/d	2,000	2006	Concession extended 2010 to 2030.
Do.	Block 0 - North Nemba	do.	40,000 bbl/d		2001	
ChevronTexaco Corp. 3/	Block 14 - Kuito	do.	80,000 bbl/d	400	2001	Discovered 1997; 400 Mbbl.
Do.	Block 14 - Kuito Phase 3 Development	do.	55,000 to 85,000 bbl/d	50	October 2001	
Do.	Block 14 - Benguela	do.				Discovered January 1998.
Do.	Block 14 - Landana	do.				Discovered October 1998.
Do.	Block 14 - Landana 2a	do.				Discovered December 2001.
Do.	Block 14 - Belize	do.				Discovered 1998.
Do.	Block 14 - Tombocco	do.				Discovered October 2000.
Do.	Block 14 - Lobito-1X	do.				Do.
Do.	Block 14 - Tombua	do.				Discovered July 2001.
Do.	Block 14 - Gabela-1	do.				Discovered July 2002.
Do.	Benguela/Belize Development	do.	140,000 bbl/d			
Do.	Block 14 - Negage	do.				Discovered December 2002.
ChevronTexaco (32%) and Sonangol (20%)	Luanda LNG plant	Natural gas	5 billion cubic meters per year (4 Mt/yr)	2,000	2006	Gas processing plant; Angolan natural gas reserves=270 billion cubic meters.
ChevronTexaco summary	Block 14 total			6,000	by 2006	3 Gbbl.
ExxonMobil Angola 4/	Block 15 - Kissanje	Petroleum				Discovered 1998.
Do.	Block 15 - Marimba	do.				Do.
Do.	Block 15 - Hungo	do.				Do.
Do.	Block 15 - Dikanza	do.				Do.
Do.	Block 15 - Chocalho	do.				Discovered July 1999.
Do.	Block 15 - Xicomba	do.				Discovered September 1999.
Do.	Block 15 - Xicomba FPSO	do.	80,000 bbl/d		2003	100 Mbbl reserves.
Do.	Block 15 - Mondo	do.				Discovered June 2000.
Do.	Block 15 - Saxi-1	do.				Discovered August 2000.
Do.	Block 15 - Batuque-1	do.				Discovered November 2000.
Do.	Block 15 - Kizomba-A FPSO	do.	250,000 bbl/d	3,100	2004	Develops Hunga and Chocalho fields, 1 Gbbl reserves.
Do.	Block 15 - Kizomba-B FPSO	do.	330,000 bbl/d		2006	Develops Kissanje and Dikanza fields, 1 Gbbl reserves.
Do.	Block 15 - Mblumbumba-1	do.				Discovered April 2001.
Do.	Block 15 - Vicango-1	do.				Discovered May 2001.
Do.	Block 15 - Mavacola-1	do.				Do.
Do.	Block 15 - Reco Reco-1	do.				Discovered Sept., 2002
Sonangol (50%)	Lobito refinery	Petroleum, refined	200,000 bbl/d	3,600	2006	Seeking finance in 2002.
ExxonMobil Angola 5/	Block 24 - Semba-1	Petroleum				
ExxonMobil summary				NA		Block 15, 4 Gbbl reserves.
Canadian Natural Resources Ltd. 6/	Block 16	do.				
TotalFinaElf 7/	Block 17 - Girassol FPSO	do.	200,000 bbl/d	3,000	2001	Discovered 1996; 800 Mbbl.
Do.	Block 17 - Dalia	do.	300,000 bbl/d	3,000	2006	Discovered 1997.
Do.	Block 17 - Rosa	do.				Discovered 1998.
Do.	Block 17 - Liro	do.		3,000	2002+	Do.
Do.	Block 17 - Tulipa	do.				Discovered June 1999.
Do.	Block 17 - Orquidea	do.				Discovered September 1999.
Do.	Block 17 - Cravo	do.				Discovered October 1999.
Do.	Block 17 - Camelia	do.				Discovered December 1999.
Do.	Block 17 - Jasmine	do.				Discovered 2000.

See footnotes at end of table.

Digitized by Google

TABLE 2--Continued
ANGOLA: OIL AND GAS DISCOVERIES AND PROPOSED INVESTMENT, 1996-2011 1/

Operating Company	Development	Commodity	Capacity	Investment (million dollars)	Startup date	Comments, reserves etc.
TotalFinaElf--Continued: 7/	Block 17 - Perpetua 1	Petroleum				Discovered December 2000.
Do.	Block 17 - Violeta	do.				
Do.	Block 17 - Anturio	do.				
Do.	Block 17 - Zinia-1	Petroleum				Discovered December 2002.
Do.	Block 17 - Hortensia- 1	do.				Discovered March 2003.
Do.	Block 17 - Acacia	do.				Discovered March 2003.
TotalFinaElf 8/	Block 32 - Gidungo-1	Exploration October 2002				
TotalFinaElf summary				NA		
BPAmoco 9/	Block 18 - Platina	do.				Discovered 1999.
Do.	Block 18 - Plutonio	do.				Do.
Do.	Block 18 - Galio	do.				Discovered 2000.
Do.	Block 18 - Paladio	do.				Do.
Do.	Block 18 - Cromio	do.				Discovered October 2000.
Do.	Block 18 - Cobalto	do.				Discovered December 2000.
Do.	Plutonio/Cobalto FPSO		80,000+ bbl/d		2005	400 Mbbl reserves.
Do.	Galio/Cromio Development					300 Mbbl reserves.
BPAmoco 10/	Block 31- Plutao 1					
BPAmoco summary				7,500	by 2011	6 fields, 1 Gbbl.
Norsk Hydro ASA, 11/	Block 34	Petroleum				
Angola grand total		Petroleum	2 million bbl/d	20,000	2010	
		Natural gas	5 billion cubic meters per year	2,000	2006	

NA Not available. FPSO Floating production storage and offloading vessel.
1/ Blank column indicates no information was available.
2/ Block 0: Chevron Texaco (39.2%), Sonangol (41%), Elf Petroleum Angola (10%), and AGIP Angola Production (9.8%).
3/ Block 14: Cabinda Gulf Oil Co. (ChevronTexaco) (31%), Sonangol Pesquisa e Produção S.A.R.L. (20%), Agip Angola Exploration BV (20%), and TotalFinaElf E&P Angola (20%), and Petrogal Exploração (9%)
4/ Block 15: ExxonMobil Angola (40%), BP Exploration (Angola) Limited (26.67%), Agip Angola Exploration B.V. (20%) and Statoil Angola (13.33%).
5/ Block 24: Esso Exploration Angola (Block 24) Limited (50%), Sonangol (20%), Petronas Carigali Overseas SDN BDH (15%) and Ocean Angola Corporation (15%)
6/ Block 16: Canadian Natural Resources Ltd. (50%), Odebrecht Oil & Gas (30%), and Sonangol (20%).
7/ Block 17: TotalFinaElf (35%), ExxonMobil (20%), Sonangol (20%), BP Amoco (6.67%), Den Norske State Oljeselskap a.s. (Statoil) (13.33%), Norsk Hydro ASA (10%), and Petrofina 5%.
8/ Block 32: TotalFinaElf (30%), Sonangol (20%), Prodev (20%), ExxonMobil (15%), Marathon (10%), and Petrogal (5%).
9/ Block 18: Amoco Angola B.V. (a wholly owned subsidiary of BP) (50%),and Shell Development Angola B.V. (50%).
10/ Block 31: BP (26.7%), ExxonMobil (25%), Statoil (13.3%), Marathon (10%), TotalFinaElf (5%), and Sonangol, (20%).
11/ Block 34: Sonangol (20%), Norsk Hydro (30%), Phillips Petroleum (20%), Shell (15%), and Petrobras (15%).

Source: U.S. Geological Survey compilation from published company and Angolan Government data available through December 2002.

Digitized by Google

Digitized by Google

BENIN, CAMEROON, CAPE VERDE, THE CENTRAL AFRICAN REPUBLIC, GABON, SÃO TOMÉ E PRÍNCIPE, AND TOGO

By Philip A. Szczesniak

BENIN

In 2001, the mineral industry of Benin was a minor component of the national economy with some offshore oil exploration and production of cement, gold, and petroleum. Other mineral resources include clay, iron ore, limestone, marble, phosphate, silica sand, and titanium. The gross domestic product (GDP) was estimated on the basis of purchasing power parity to be about $9.96 billion in 2001; leading industries were agriculture and services. Benin's population in 2000 was estimated to be 6.3 million (World Bank, 2001a§[1]; International Monetary Fund, 2002§).

The Ministère des Mines, de l'Energie, et de l'Hydraulique is responsible for the administration of the mining sector. The Office Béninois de Recherches Géologiques et Minières is responsible for mineral development administration duties. All mineral resources belong to the Government, which grants exclusive rights for exploration and development. To attract future investment in the mining sector, the Government continued to seek ways to revise and improve its mining laws.

In the petroleum sector, Zetah Oil Co. of Côte d'Ivoire signed a 25-year production contract for the Sèmè field in 2000. This field had been closed by the Government in 1998 owing to environmental concerns. Although Zetah Oil projected that production could reach between 2,500 and 5,000 barrels per day (bbl/d), it only produced an estimated 1,000 bbl/d in 2000 and 2001 (World Oil, 2000; Oil & Gas Journal, 2001). In 2001, Kerr-McGee Corporation of the United States signed a contract to explore for oil in offshore Benin; the deepwater area covers 1 million hectares (2.5 million acres) with water depths that ranged from about 90 to about 3,000 meters (300 to 10,000 feet) (Offshore Engineer, 2001).

Electricity in Benin was provided by the state-owned Société d'Eau et d'Electricite (SBEE). SBEE recently launched several programs with financial help from the World Bank and the Agence Francaise de Développement—a $30 million interconnection of the North Togo-North Benin networks designed to link up the towns of Dara in Togo and Parakou in Benin; a $21 million interconnection of the Nigerian Energy Power Authority's network designed to link up Porto Novo and Nigeria via the city of Ikeja; and a dam at Arjarala with a 900-megawatt (MW) hydroelectric power station at an estimated cost of $150 million (Africa Energy & Mining, 2000a).

In November, a free trade zone was established in the countries of Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali, Niger, and Nigeria. Although the President of the Lagos Chamber of Commerce and Industry in Nigeria approved of the new trade zone, she expressed regrets that it had not been realized by 2000, which had been a prior goal. She noted that delays in payment systems, inadequate information about trade opportunities, high transportation costs, and poor infrastructure were factors that could adversely affect the free trade zone (Guardian Online, 2001§).

CAMEROON

Mining played a minor role in Cameroon's economy in 2001. Agriculture, which was the leading sector, accounted for more than 40% of the GDP, which was estimated to be $34.87 billion in 2001 calculated on the basis of purchasing power parity (International Monetary Fund, 2002§). Crude oil production, which was the most significant segment of the mineral industry, accounted for nearly 50% ($989 million) of the country's total exports of $2.1 billion in 2000. Cameroon had an estimated population of more than 15 million people in 2000 (World Bank, 2001b§). Cameroon's other mineral resources include bauxite, cobalt, diamond, gold, iron ore, limestone, marble, natural gas, nickel, rutile, sand and gravel, tin, and uranium.

The Ministère de Mines, de l'Eau et de l'Energie is responsible for the administration of the mining sector. State-owned Société Nationale des Hydrocarbures (SNH) was involved in hydrocarbon production, and state-owned Société Nationale de Raffinage managed the crude oil refinery (MBendi Information Services (Pty) Ltd., 2000b§).

In April, a new mining law was passed that replaced regulations that dated back to 1964. The main change involved a move towards greater transparency in the regulations and Government officials dealing with investors on a first-come-first-serve basis. A new investment incentive included a holiday for tax and import duties during the exploration phase and on production equipment during the construction phase through to commercial production. A new requirement included companies having to present an environmental impact assessment and signing a mining convention with the Government setting out and guaranteeing investment terms (Mining Journal, 2001).

Cameroon's largest company was Compagnie Camérounaise de l'Aluminium (Alucam) [a joint venture of Pechiney of France (58%) and the Government (42%)]. The aluminum smelter at Edéa was owned and operated by Alucam. Alucam's alumina was imported from Guinea (MBendi Information

[1]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

Services (Pty) Ltd., 2000a§). Alucam's estimated production capacity at Edéa was 90,000 metric tons per year (t/yr) (Altech.com, undated§).

The main petroleum operators in Cameroon were Elf Serepca (a subsidiary of TotalFinaElf of France), Pecten Cameroon Co. (a subsidiary of Shell Exploration and Production Co. of the United Kingdom), and Perenco plc of the United Kingdom. Oil production has steadily declined since 1998.

In 2001, two exploration licenses were awarded. One license to explore for oil on the area known as Nsepe was awarded to a consortium made up of SNH and the American firms CMS Oil & Gas Co. and Globex Energy, Inc. During the initial 3-year exploration period, the consortium pledged to spend at least $5.5 million for the reprocessing of existing seismic data, acquisition, processing, and interpretation on new 2-D and 3-D seismics, aeromagnetic, and gravity surveys and a well in the Souellaba area (Africa Energy Intelligence, 2001a). A license to explore for natural gas on the Logbaba gasfields was awarded to RSM Production Corporation of the United States (a subsidiary of Grynberg Petroleum of the United States). Company officials noted that $3.5 billion would be invested during a period of 6 years (Alexander's Gas & Oil Connections, 2001§).

In July, AES Corp. of the United States signed an agreement to acquire 56% of the Cameroon electrical utility Societe Nationale d'Electricite du Cameroun (SONEL) for $70 million. The remainder was controlled by the Government. SONEL was one of the largest electrical utilities in Africa with 800 MW of installed capacity, of which 90% was hydroelectric power. Government officials noted that the contract sale was awarded to AES Corp. because it was the best positioned to improve efficiency in production, transmission, and distribution of power and to supply electricity in sufficient quantity and at competitive prices (Africa Energy Intelligence, 2001b).

The African Development Bank Group approved a $19.38 million loan to finance the West, Litoral, and South Provinces road development project in Cameroon in March 2001. The objective of the project was to improve the serviceability of the priority network and contribute towards opening up the country internally and externally. Among the work to be completed was the construction of a 45-kilometer (km) dual carriageway paved road between Melong and Dschang (African Development Bank Group, 2001§).

CAPE VERDE

The contribution of mining to the economy of Cape Verde, an archipelago of 10 islands and 8 islets about 600 km off the west coast of Africa, was minimal in 2001. Commerce, public services, and transport accounted for almost 70% of GDP, which was estimated to be $1.73 billion in 2001 calculated based on purchasing power parity (International Monetary Fund, 2002§). Cape Verde's population was estimated to be 440,000 in 2000 (World Bank, 2001c§).

Most of the nation's mineral requirements were imported. Salt was produced on the island of Sal and Mindelo, and volcanic rock (primarily pozzolana) was produced on Santo Antao. There also was intermittent production of clay on Sao Vicente, Boa Vista, and Sal; gypsum on Maio; and limestone on Boa Vista, Sal, and Santo Antao. For environmental reasons, the Government strongly discouraged mining beach sand for construction material.

The oil and gas industry was regulated by the Direcao Geral da Energia. The 40,000 t/yr of refined petroleum products that was consumed was imported either from Portugal or other African countries. Distribution and marketing of fuels was carried out by state-owned Empresa Nacional de Combustiveís, s.a.r.l., and Shell Cabo Verde s.a.r.l. No oil or gas was domestically produced; in fact, no oil or gas reserves were known (MBendi Information Services (Pty) Ltd., 2000c§).

Economic reforms on the part of the Government aim to achieve three goals—to develop the private sector, to attract foreign investment, and to diversify the economy. Commerce, public services, and transport will continue to be major components of an economy, which is dependent on foreign aid.

CENTRAL AFRICAN REPUBLIC

In 2001, the mining sector in the Central African Republic, which was dominated by the production of diamond and some gold, remained a small component of the economy. Other mineral resources that have been identified include clay, copper, graphite, iron ore, lignite, limestone, rutile, tin, and uranium. The GDP was estimated to be $5.61 billion on the basis of 2001 purchasing power parity; agriculture accounted for more than 50% of the country's GDP. The Central African Republic's population was estimated to be 3.6 million in 2000 (World Bank, 2001d§; International Monetary Fund, 2002§).

The Ministère des Ressources Energetiques et Minerales was responsible for the administration of the mining sector in the Central African Republic. In 2000, after several years of recommending changes to the Government's mining laws, the World Bank took an active role in helping draft a new code by sending experts to the Central African Republic as part of a $20 million loan package. World Bank and International Monetary Fund (IMF) officials hoped for the acceptance of new legislation that would bar the Government from involving itself directly in mining ventures; authorizing the sale of oil and gas licenses by auction to conform to the Organization for the Harmonization of Business Law in Africa Treaty (also known as the Treaty for Harmonization of African Business Laws, which was signed in 1993); and using international prices as benchmarks (Africa Energy & Mining, 2000b).

Diamond and gold were recovered by artisanal miners primarily from the regions of Berbérati, Upper Kotto, and Sangha. Most of the diamond deposits were situated along northern flowing rivers coming from Congo (Kinsasha) (MBendi Information Services (Pty) Ltd., 2001§). Among the companies exploring for diamond and gold were Axmin Resources Ltd. of the United Kingdom, Diamondworks Ltd. of Canada, and Vaaldiam Resources Ltd. of Canada.

The lack of adequate transportation and industrial infrastructure hindered the development of the nation's mineral industry. Little of the country's 400,000-square-kilometer Precambrian terrain has been explored by modern exploration techniques (Knopf, 1999).

GABON

In 2001, the mining sector in Gabon, which was dominated by crude petroleum production, remained a big component of the economy, about 50% of GDP. Other mineral commodities that were produced were cement, diamond, gold, manganese, natural gas, and uranium. Resources of columbium (niobium), iron ore,

Digitized by Google

and phosphate were also known. The GDP, which was based on 2001 purchasing power parity, was estimated to be $9.07 billion. Gabon's population was estimated to be 1.2 million in 2000 (World Bank, 2001e§; International Monetary Fund, 2002§).

The Ministère des Mines, de l'Energie et du Petrole is responsible for the administration of the mining sector in Gabon. The Mining Code was revised in 1997 and comprises an exploration permit valid for 3 years and twice extendible for a further 3-year period. Mining permits are granted for 5 years and may be renewed for an additional 5 years, and mining concessions are granted for 25 years and may be renewed for an additional 10 years. Corporate taxes are 35%. Ownership of oil and gas and all mineral rights were vested in the Government (Resource Information Unit, 2002, p. 99).

Eramet Manganese (58% owned by Eramet Group of France) operated the Compagnie Miniere de l'Ogooue S.A. (Comilog) Moanda manganese mine near Franceville. In 2001, manganese production increased to 1.79 million metric tons. The Moanda Mine had a capacity of 2.5 million metric tons per year with an estimated 100 years of resources (Eramet Group, 2001§). In late 2000, Comilog started manganese production from its new Moanda Industrial Complex with a capacity of 600,000 t/yr of sintered manganese ore. The new plant was not expected to have much impact on the global manganese market because it simply changes some of Gabon's exports of lump ore manganese to aggregate ore manganese. Future plans were to advance the industry in Gabon to the production of ferromanganese; however, insufficient electricity production remained an obstacle (Metal Bulletin, 2001).

In 2001, officials from the IMF called on the Government to audit its oil companies annually and to contribute a fraction of its oil receipts to a "Reserve for Future Generations" account. In addition, the IMF insisted that Gabon adopt a bill against corruption (Africa Energy Intelligence, 2001c). Proven reserves of petroleum were estimated to be about 2.5 billion barrels (Gbbl) in 2001 which were nearly double the 1996 figure of 1.3 Gbbl. Total production of crude oil in 2001 was 110 million barrels (Mbbl) (or about 300,000 bbl/d), which was about 14% below a level of 350,000 bbl/d established and maintained by the Government to ensure a consistent amount of production until new discoveries could be brought into production. The largest oilfield was the Rabi-Kounga Oilfield operated by Shell Oil; estimated reserves were 440 Mbbl, and production was 150,000 bbl/d. About 20 companies have oil interests in Gabon (MBendi Information Services (Pty) Ltd., 2000d§).

The transportation infrastructure of Gabon remained underdeveloped. The asphalting of roads, which was a priority of the National Investment Program, has only been completed on 10% of roads. A railway concession was awarded to a private operator with the hopes of enhancing the volume and quality of the railway networks. Air and water transportation are also very important to the movement of goods and tourists around the country; however, they remain costly and the Government continued to pursue privatization efforts (World Trade Organization, 2001§).

SÃO TOMÉ E PRÍNCIPE

The contribution of mining to the economy of São Tomé e Príncipe, an archipelago 275 km west of Gabon and southwest of Equatorial Guinea and Cameroon in west Africa, was minimal in 2001. Agriculture, light construction, and textiles were large components of the GDP, which was estimated to be $0.19 billion in 2001 calculated on the basis of purchasing power parity (International Monetary Fund, 2002§). The economy seemed to be helped after the Government was granted $200 million in debt relief in 2001 by the World Bank Group's International Development Fund and the IMF under the Initiative for Heavily Indebted Poor Countries Program. São Tomé e Príncipe's population was estimated to be 150,000 in 2000 (World Bank, 2001f§).

The oil and gas industry in São Tomé e Príncipe is regulated by the Ministry of Industry, Construction, and Housing. Refined petroleum products as well as most manufactured goods and food were imported from neighboring countries. In early 2001, Government officials announced an agreement with Nigerian officials regarding the disputed offshore areas in the São Toméan part of the Gulf of Guinea; according to the signed treaties, Nigeria and São Tomé will obtain 60% and 40%, respectively, of the revenues from oil exploration in these areas (Africa Energy Intelligence, 2000; Afrol.com Information Services, 2001§).

TOGO

In 2001, mining played a minor role in Togo's economy. Agriculture was the leading sector and accounted for nearly 40% of the GDP, which was estimated to be $7.20 billion in 2001 calculated on the basis of purchasing power parity (International Monetary Fund, 2002§). Minerals produced were cement, limestone, and phosphate rock (some artisanal production of diamond and gold). Togo's other mineral resources include bauxite, gypsum, manganese, marble, iron ore, rutile, and zinc. Togo had an estimated population of 4.7 million people in 2000 (World Bank, 2001g§).

The Ministère de l'Equipment, des Mines, de l'Energie et des Postes et Telecommunications is responsible for the administration of the mining sector in Togo. The Government continued to pursue the privatization of its phosphate mines, which were operated by the Office Togolais des Phosphates; no serious offers, however, were made. Business profits are taxed at 40%.

In May, Hunt Oil Co. of the United States signed a production-sharing agreement with the Government to explore for oil on Togo's entire offshore area. Under the contract, Hunt Oil pledged to fulfill its obligations for an investment program for a maximum exploration period of 3 years and possible exploitation during a period of 30 years (Panapress.com, 2002§).

In 2000, as a condition for financial backing of its energy sector by the World Bank, the Government succeeded in the privatization of Compagnie d'Energie Electrique du Togo to Elyo/Hydro Quebec International of Canada. Part of the agreed upon 20-year contract was the establishment of a new company named Togo Electricite of which Elyo/Hydro Quebec International would be the main shareholder. Togo Electricite was expected to invest 40 million euros during a 5-year period to rehabilitate and develop the production and distribution infrastructure (Africa Energy & Mining, 2000c).

By using Nigeria's more than 40 trillion cubic feet of natural gas reserves, a consortium led by Chevron Nigeria Ltd. committed to building the West African Gas Pipeline by 2002. An 800-km offshore gas pipeline will be constructed from the

Digitized by Google

Niger Delta to the west coast city of Effuasi, Ghana, and supply an initial amount of 120 million cubic feet per day of gas to existing and planned powerplants in Benin, Ghana, and Togo (Chevron Nigeria Ltd., 1999§; AllAfrica.com, 2000§).

References Cited

Africa Energy Intelligence, 2000, Nigeria & Sao Tome—Joint exploration accord: Africa Energy Intelligence, November 22, no. 287, p. 7.
Africa Energy Intelligence, 2001a, Cameroon—Exploration license for CMS and Globex: Africa Energy Intelligence, March 7, no. 294, p. 2.
Africa Energy Intelligence, 2001b, Cameroon—U.S. company wins Sonel: Africa Energy Intelligence, March 21, no. 295, p. 2.
Africa Energy Intelligence, 2001c, Gabon—IMF wants a yearly audit of oil companies: Africa Energy Intelligence, July 18, no. 303, p. 7.
Africa Energy & Mining, 2000a, Benin—SBEE's projects: Africa Energy & Mining, no. 270, February 23, p. 5.
Africa Energy & Mining, 2000b, Central African Republic—New mining code in sight: Africa Mining & Energy, May 3, no. 274, p. 7.
Africa Energy & Mining, 2000c, Togo—Elyo to take over CEET: Africa Energy & Mining, September 13, no. 282, p. 5.
Knopf, David, 1999, Gold targets in Cameroon, Chad and the CAR: Mining Journal, v. 332, no. 8521, March 5, p. 160-161.
Metal Bulletin, 2001, Comilog starts up manganese project: Metal Bulletin, January 29, p. 7.
Mining Journal, 2001, Cameroon revises mining law: Mining Journal, v. 336, no. 8600, May 11, p. 353.
Offshore Engineer, 2001, Big in Benin: Offshore Engineer, February, p. 6.
Oil & Gas Journal, 2001, Worldwide production—Benin: Oil & Gas Journal, December 24, p. 132.
Resource Information Unit, 2002, Register of African mining 2001/2002: Subiaco, Western Australia, Australia, Resource Information Unit, 350 p.
World Oil, 2000, Africa news: World Oil, August, p. 90.

Internet References Cited

African Development Bank Group, 2001 (March 29), The African Development Fund approves $19.38 million loan to finance the West, Litoral, and South Provinces road development project in Cameroon, accessed July 10, 2002, at URL http://www.afdb.org/knowledge/loans2001/adf_W_litoral_S_road_Cameroon.htm.
Afrol.com Information Services, 2001 (March 24), São Tomé reaches agreement on oil exploration with Nigeria, accessed August 1, 2001, at URL http://www.afrol.com/NEWS2001/stp001_oil_nigeria.htm.
Alexander's Gas & Oil Connections, 2001 (June 7), RSM to exploit natural gas in Cameroon, accessed July 10, 2002, at URL http://www.gasandoil.com/goc/company/cna12908.htm.
AllAfrica.com, 2000 (November 13), West African gas pipeline co-operating for energy security, accessed January 20, 2001, at URL http://allafrica.com/stories/200011130108.html.
Altech.com, [undated], Alucam, accessed August 12, 2002, at URL http://www.altech.is/Smelters/alucam.htm.
Chevron Nigeria Ltd., 1999 (August 16), Chevron named project manager for west African gas pipeline project, accessed November 9, 2001, at URL http://www.chevrontexaco.com/news/archive/chevron_press/1999/1999-08-16.asp.
Eramet Group, 2001 (March 29), Annual report 2000, accessed July 31, 2001, at URL http://www.eramet.fr/anglais/download/ANNUAL_REPORT_GLOBAL.pdf.
Guardian Online, 2001 (November 6), Nigeria, six others form free trade zone, accessed November 6, 2001, at URL http://www.ngrguardiannews.com/news2/nn838705.html.
International Monetary Fund, 2002 (April), The world economic outlook database, accessed June 12, 2002, at URL http://www.imf.org/external/pubs/ft/weo/2002/01/data.
MBendi Information Services (Pty) Ltd., 2000a (November 15), Cameroon—Mining, accessed July 30, 2001, at URL http://www.mbendi.co.za/indy/ming/af/ca/ p0005.htm.
MBendi Information Services (Pty) Ltd., 2000b (July 12), Cameroon—Oil and gas industry, accessed July 30, 2001, at URL http://www.mbendi.co.za/indy/oilg/af/ca/p0005.htm.
MBendi Information Services (Pty) Ltd., 2000c (August 3), Cape Verde—Oil and gas industry, accessed March 21, 2001, at URL http://www.mbendi.co.za/indy/oilg/af/cv/p0005.htm.
MBendi Information Services (Pty) Ltd., 2000d (July 12), Gabon—Oil and gas industry, accessed April 2, 2001, at URL http://www.mbendi.co.za/indy/oilg/af/ga/p0005.htm.
MBendi Information Services (Pty) Ltd., 2001 (March 8), Central African Republic—Mining, accessed July 12, 2002, at URL http://www.mbendi.co.za/indy/ming/af/cr/p0005.htm.
Panapress.com, 2002 (February 1), Glimmer of hope for Togolese economy in 2001, accessed July 23, 2002, at URL http://www.panapress.com/newslat.asp?code=eng029761&dte=02/01/2002.
World Bank, 2001a (November 1), Benin at a glance—2000, accessed February 26, 2002, via URL http://www.worldbank.org/data/countrydata/countrydata.html#AAG.
World Bank, 2001b (October 2), Cameroon at a glance, accessed February 26, 2002, via URL http://www.worldbank.org/data/countrydata/countrydata.html.
World Bank, 2001c (September 27), Cape Verde at a glance, accessed February 26, 2002, via URL http://www.worldbank.org/data/countrydata/countrydata.html.
World Bank, 2001d (September 21), Central African Republic at a glance, accessed February 26, 2002, via URL http://www.worldbank.org/data/countrydata/countrydata.html.
World Bank, 2001e (October 9), Gabon at a glance, accessed February 26, 2002, via URL http://www.worldbank.org/data/countrydata/countrydata.html.
World Bank, 2001f (September 6), São Tomé e Príncipe at a glance, accessed February 26, 2002, via URL http://www.worldbank.org/data/countrydata/countrydata.html.
World Bank, 2001g (October 9), Togo at a glance, accessed March 22, 2002, via URL http://www.worldbank.org/data/countrydata/countrydata.html.
World Trade Organization, 2001 (June 28), Trade policy review body—Gabon, accessed July 22, 2002, at URL http://www.wto.org/english/tratop_e/tpr_e/tp168_e.htm.

Major Sources of Information

Office Béninois de Recherches Géologiques et Minières
Ministère de l'Energie des Mines et de l'Hydraulique
B.P. 249
Contonu, Benin
Telephone: (229) 31-03-09
Fax: (229) 31-35-46

Ministère de Mines, de l'Eau et de l'Energie
P.O. Box 955
Yaounde, Cameroon
Telephone: (237) 22-34-00
Fax: (237) 22-61-77

Cabo Verde Instituto de Apoio ao Desenvolvimento Empresarial (Cape Verde Institute for the Development of Enterprises)
Av. Cidade de Lisbao
C.P. 581
Praia, Ilha de Santiago, Republica de Cabo Verde
Telephone: (238)-614444/631395
Fax: (238)-612434

Ministère des Ressources Energetiques et Minerales
Direction Generale des Ressources Minerales
Bangui, Central African Republic
Telephone: (236) 61-20-54

Ministère des Mines, de l'Energie et du Petrole
Direction Generale de Mines et de la Géologie
B.P. 576
Libreville, Gabon
Telephone: (241) 76-35-56
Fax: (241) 72-49-90

Ministère de l'Equipment, des Mines, de l'Energie et des Postes et Telecommunications
Direction Generale des Mines et de la Géologie
B.P. 356
Lome, Togo
Telephone: (228) 213 001
Fax: (228) 213 193

Digitized by Google

TABLE 1
BENIN, CAMEROON, CAPE VERDE, CENTRAL AFRICAN REPUBLIC, GABON, AND TOGO: ESTIMATED PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/	1997	1998	1999	2000	2001
BENIN					
Cement, hydraulic	200,000 r/	200,000 r/	200,000 r/	250,000 r/	250,000
Gold kilograms	500	500	500	500	500
Petroleum, crude thousand 42-gallon barrels	400	200	--	365 r/	365
CAMEROON					
Aluminum metal, primary	90,900 r/ 4/	81,600 r/ 4/	90,410 r/ 4/	86,384 r/ 4/	80,500 4/
Cement, hydraulic	620,000	740,000 r/ 4/	850,000 r/ 4/	890,000 r/ 4/	930,000 4/
Clay	10,000	10,000	13,472 4/	21,558 4/	22,000
Gold, mine output, Au content kilograms	1,000	1,000	1,000	1,000	1,000
Petroleum:					
Crude thousand 42-gallon barrels	43,000	45,000	43,600 r/	41,000 r/	39,600
Refinery products do.	9,200	10,000	10,000	10,000	10,000
Pozzolana (ash for cement)	500,000 r/	500,000 r/	631,740 r/ 4/	604,960 r/ 4/	600,000
Sand	30,000	30,000	36,658 4/	35,078 4/	35,000
Silica sand	12,000	15,000 r/	16,088 r/ 4/	-- r/	--
Stone:					
Limestone	100,000 r/	100,000 r/	168,411 r/ 4/	258,517 r/ 4/	260,000
Marble	20,000 r/	20,000 r/	24,065 r/ 4/	21,165 r/ 4/	20,000
CAPE VERDE 5/					
Salt	1,600	1,600	1,600	1,600	1,600
CENTRAL AFRICAN REPUBLIC					
Diamond carats	500,000	400,000 r/	431,138 r/ 4/	461,004 r/ 4/	480,000
Gold kilograms	90	50 r/	41 r/	12 r/	20
GABON					
Cement:					
Clinker	176,000	180,000	180,000 4/	200,000 r/	200,000
Cement, hydraulic 6/	205,000	196,000 4/	200,000	210,000 r/	210,000
Diamond, gem and industrial carats	500	500	500	500	500
Gas, natural, gross million cubic meters	99	99	99	99	99
Gold, mine output, Au content 7/ kilograms	70	70	70	70	70
Manganese:					
Metallurgical-grade thousand metric tons ore, gross weight (50% to 53% Mn)	1,860	2,044	1,908	1,700	1,790
Pellets, battery- and chemical-grade, gross weight (82% to 85% MnO_2) do.	44	48	44	40	40
Total do.	1,904 4/	2,092 4/	1,952 4/	1,740	1,830
Petroleum:					
Crude thousand 42-gallon barrels	134,000	132,000	125,000 r/	118,625 r/ 4/	110,000
Refinery products do.	6,315 4/	6,200 4/	6,320 r/	6,320 r/	6,000
Sulfuric acid	5,000 4/	5,000 4/	2,000 4/	-- 4/	--
Uranium, content of concentrate	472 4/	862 4/	347 8/	-- 8/	-- 8/
TOGO 9/					
Cement:					
Clinker	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Cement, hydraulic 6/	421,000	500,000 r/	600,000 r/	700,000 r/	800,000
Limestone	2,400,000	2,400,000	2,400,000 4/	2,400,000 4/	2,400,000
Phosphate rock, beneficiated product:					
Gross weight thousand metric tons	2,630 r/	2,250 r/	1,600 r/ 4/	1,400 4/	1,060 4/
P_2O_5 content do.	950	810	600	500 r/	380

r/ Revised. -- Zero.

1/ Includes data available through July 2002.

2/ Estimated data are rounded to no more than three significant digits.

3/ In addition to the commodities listed, a variety of industrial minerals and construction materials (clays, gypsum, sand and gravel, and stone) are produced; but information is inadequate to make reliable estimates of output.

4/ Reported figure.

5/ Cape Verde also presumably produced clay, gypsum, limestone, and pozzolana, but output is not reported, and available information is inadequate to make reliable estimates of output levels.

6/ Includes cement produced from imported clinker.

7/ Gold production figures do not include production smuggled out of the country, which, in recent years, was estimated to exceed 400 kilograms per year.

8/ Moanda uranium mine depleted and closed in 1999.

9/ Togo also presumably produced diamond and gold, but output is not reported, and available information is inadequate to make reliable estimates of output levels.

Digitized by Google

TABLE 2
BENIN, CAMEROON, CAPE VERDE, GABON, AND TOGO: STRUCTURE OF THE MINERAL INDUSTRIES IN 2001

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
BENIN				
Cement		Ciments du Benin S.A. (Scancem International of Norway, 100%)	Cotonou plant	300,000
Do.		Société des Ciments du Benin (Lafarge of France, 100%)	Cotonou plant	300,000
Do.		Société des Ciments d'Onigbolo (Government, 100%)	Onigbolo plant	500,000
Petroleum	42-gallon barrels	Zetah Oil Company of Côte d'Ivoire (private, 100%)	Sèmè Kpodji	365,000
CAMEROON				
Aluminum		Compagnie Camérоon de l'Aluminium (Pechiney of France, 58%, Government, 42%)	Edéa	90,000
Cement		Les Cimenteries du Cameroun (Cimencam) (LaFarge, 50%; Government, 50%)	Doula, Bonaberi, Figuil, Maroua	1,200,000
Limestone		Cimencam	Figuil	272,000
Marble		do.	Nord Province	25,000
Petroleum, crude	42-gallon barrels	TotaFinaElf (private, 100%)	Kole, Bora-Asoma, Boa, Ekoundou	29,000,000
Do.	do.	Pecten (private, 100%)	Mokoko-Abana, Lipenja	11,000,000
Do.	do.	Perenco (private, 100%)	Moudi, Kribi	3,700,000
Petroleum products	do.	Societe Nationale de Raffinage (Government, 66%; private, 34%)	Limbe refinery	15,000,000
Pozzolana		Cimencam	Sud-Ouest and Littoral Provinces	750,000
CAPE VERDE				
Salt		Groupe Salins de France (private, 100%)	Sal and Mindelo Islands	2,000
GABON				
Cement		Ciments du Gabon [Scancem Interntional (Sweden), 75%; private shareholders, 25%]	Cement-grinding plant at Owendo	270,000
Do.		do.	Cement-grinding plant at Franceville	130,000
Clinker		do.	Clinker plant at N'Toum, 40 kilometers east of Libreville	350,000
Manganese, ore		Compagnie Minière de l'Ogooué (Eramet, 58%; Government, 27%; and others, 16%)	Open pit mine at Moanda	2,500,000
Petroleum, crude	thousand 42-gallon barrels	Elf Gabon (Société Nationale Elf Aquitaine 58%; Government, 25%; and others, 17%)	Anguille, Barbier, Baudroie, Bréme, Gonelle, Grondin Marine, Mandaros, and Torpille offshore fields	30,000
Do.	do.	do.	Avocette, Coucal, and Hylia fields	25,000
Do.	do.	Shell Gabon (Royal Dutch-Shell, 75%; Government, 25%)	Rabi Kounga field, 100 kilometers north of Gamba	75,000
Do.	do.	do.	Gamba-Ivinga field, onshore Gamba	4,000
Do.	do.	Perenco Plc., 45% interest in field	Oguendjo offshore field, 85 kilometers southeast of Port Gentil	3,000
Do.	do.	Perenco Plc., 75%, and Government, 25% (joint venture)	Lucina Marine offshore field, 15 kilometers south of Mayumba	2,000
Do.	do.	Perenco Plc., 50%, and London and Scottish Marine, 50% (joint venture)	Obando, Octopus, and Pelican offshore fields, 60 kilometers southwest of Port Gentil	5,000
Petroleum products	do.	Société Gabonaise de Raffinage (Government, 25%; Elf Gabon, 18.7%; Total, 18.7%; Agip, 6.2%; BP, 6.2%; Fina, 6.2%; Mobil, 6.2%; Shell, 6.2%; and Texaco, 6.2%)	Refinery at Port Gentil	8,760
TOGO				
Cement		Ciments du Togo (Heidelberger, 100%)	Lomé plant	600,000
Clinker		West African Cement (Indian Kenyan Co., 100%)	Lomé plant	1,400,000
Limestone		Ciments de l'Afrique de l'Ouest (private, 100%)	Tabligbo	2,400,000
Phosphate		Office Togolais des Phosphates (Government, 100%)	Hahotue and Akoumape mines	2,000,000

Digitized by Google

THE MINERAL INDUSTRY OF

BOTSWANA

By George J. Coakley

The Republic of Botswana is a landlocked nation in southern Africa surrounded by Namibia to the west, South Africa to the east and south, and Zambia and Zimbabwe to the north. It covers an area of 600,379 square kilometers and supported a population of 1.6 million in 2001. The diamond sector, which continued to be the mainstay of the economy, accounted for about 35% of the gross domestic product, 45% of Government revenues, and 85% of export earnings. Botswana was the world's largest producer of diamond by value. Copper, nickel, and soda ash production also played significant though smaller roles in the national economy. The mining and quarrying sector accounted for 8,300 jobs, or about 3% of the total formal sector workforce in 2001 (International Monetary Fund, 2002§[1]).

The value of mineral production in 2001 was approximately $2.21 billion, of which diamond accounted for $1.94 billion, or 88%; copper-nickel-cobalt, for $234 million; and soda ash, for $40 million. The value of coal and salt production was about $12 million. For the major commodities, the value of production was approximately equal to the value of mineral exports. Diamond production increased by 13% between 1999 and 2001 to more than 26 million carats because of the new Orapa Mine expansion, which came onstream in May 2000. During this period, copper and nickel smelter production declined by 8% and 2%, respectively, affected chiefly by weak global demand and prices. Demand for most metals is typically cyclical and follows global business and economic cycles.

HIV/AIDS remained a major economic, health, and social problem for Botswana. At the end of 2001, Botswana had the highest infection rate in the world; 38.8% of adults between 15 and 49 years of age was infected by the disease, with 26,000 AIDS deaths in 2001. HIV/AIDS was having an increasing impact on overall economic growth and on agricultural and industrial productivity with 18% of the workforce expected to be lost to AIDS by 2005 and more than 30%, by 2020 (Joint United Nations Programme on HIV/AIDS, 2002§).

Government Policies and Programs

The Ministry of Minerals, Energy and Water Affairs has responsibility for coordinating development and operational activities in the energy, minerals, and water sectors. Specific program responsibilities are carried out by Ministry departments, which include Geological Survey Mineral Promotion, Mines and Water Affairs, and two parastatal organizations, Botswana Power Corp. and Water Utilities Corp. Mining was governed by the Mines and Minerals Act No. 17 of July 1999, which was designed to promote new foreign investment in exploration and mine development. The new Act continues to vest all mineral rights in the State but has introduced a new "Retention License" that guarantees security of tenure from exploration to development and allows a company to retain its rights for a 3-year period, renewable once for not more than 3 years if then-current market conditions are not favorable to exploit the deposit. The Act sets out guidelines for prospecting and mining licenses, environmental protection measures, royalties, and mining taxation. The Government retains an option to acquire up to a 15% interest in new ventures on commercial terms, thus abolishing its previous free equity participation (News Africa.com, 2001§). Oil and gas exploration and development is governed by the Petroleum (Exploration and Production) Act of May 1983. Investment in diamond mining is subject to a negotiated agreement with the Government. The Precious and Semi-precious Stones (Protection) Act of 1969 provides for the protection of the precious stones industry and regulates dealings in precious stones and semiprecious stones.

Structure of the Minerals Industry

The Government maintained an equity position in most of the major mining companies, but the industry was operated, for the most part, on a privately owned, free market basis. Debswana Diamond Co (Proprietary) Ltd., which was the country's largest mining company, was a 50-50 joint partnership between the Government and De Beers Centenary AG (owned by Anglo American plc of the United Kingdom). The joint partnership also held equity positions in several other major mining companies, which included the nickel-copper-cobalt producers Bamangwato Concessions Ltd. (BCL) (Government, 35%; Anglo American, 23%) and Tati Nickel Mining Co. (Pty.) Ltd. (Anglo American, 43.35%; LionOre Mining International Ltd. of Canada, 41.65%; Government, 15%) and the soda ash company Botswana Ash (Pty.) Ltd. (Government, 50%; Anglo American, 21%). In June 2000, AngloAmerican sold its interest in Morupule Colliery (Proprietary) Ltd., which was the country's only coal mine, for $2.8 million to Debswana, which then had a 93% controlling interest in Morupule. In addition to these major operations, the mining industry consisted of a number of medium- and small-scale mines that produced agate, aggregates, brickmaking clay, gold, and dimension stone.

Commodity Review

Metals

Cobalt, Copper, and Nickel.—BCL owned and operated the Phikwe, Selebi, and Selebi North cobalt-copper-nickel mines and a smelter at Selebi-Phikwe about 350 kilometers (km) northeast of the capital of Gaborone. In addition to treating its

[1]A reference that includes a section twist (§) is found in the Internet References Cited section.

Digitized by Google

own ore, BCL toll-smelted concentrate and ore for Tati Nickel. During 2001, BCL produced 14,900 metric tons (t) of copper and 12,600 t of nickel metal contained in concentrates; thus was down from 16,300 t of copper and 13,400 t of nickel in concentrates in 2000. High costs and weak metal prices led the Government to commission a strategic review of BCL's operations in December 2001. The report will be due in March 2002 and will make recommendations on the future directions of BCL, which had sufficient remaining resources to remain open until 2010 (Murray, 2002). Reserves and resources as of yearend 2001 at BCL, prorated from Anglo American's 23% share, totaled 29.1 million metric tons (Mt) of proved and probable reserves at a grade of 0.87% copper and 0.76% nickel plus additional measured and indicated resources estimated to be 30.4 Mt at a grade of 0.74% copper and 0.62% nickel (Anglo American plc, 2002§).

Tati operated the Phoenix open pit nickel-copper mine, the Selkirk underground mine, and a magnetic separator plant near Francistown. During 2001, production at the Selkirk Mine was reduced to one-half capacity at 30,000 metric tons per year (t/yr) of ore feed as the deposit neared depletion. The mine was scheduled to be closed by mid-2002. The Phoenix Mine and dry magnetic separation plant treated 1.7 million metric tons per year (Mt/yr) of ore to produce 120,000 t/yr of nickel concentrates for direct smelting at the nearby BCL smelter. Construction of the $66 million Phoenix expansion project began in early 2001 and was expected to be completed by mid-2002. The project involved development of the infrastructure needed to bring in the electric power and water needed to support a conventional flotation and concentration plant and doubling of mine capacity to 3.6 Mt/yr of ore feed. LionOre was also pilot testing its new proprietary Activox process for the hydrometallurgical oxidation of sulfide minerals, which it felt would increase recoveries of copper, nickel, and platinum-group elements at Tati. The Activox process was a combination of fine grinding followed by pressure oxidation under mild conditions. Tati produced 6,304 t of nickel, 2,157 t of copper, 26 t of cobalt, and 4.4 kilograms (kg) of gold in 2001, all of which were significantly lower than those of 2002 as the Selkirk operation began to phase out. During 2001, the Phoenix Mine produced 124,564 t of concentrates at a grade of 5.91% nickel and 1.67% copper, and the Selkirk Mine delivered 31,341 t of ore at a grade of 2.6% nickel and 1.42% copper. The company also received byproduct credits for gold, palladium, platinum, and silver. As of December 31, 2001, mineral resources, almost entirely in the Phoenix open pit, were reported to be 165.6 Mt at a grade of 0.29% nickel and 0.20% copper, of which the mineral reserve component was 46.6 Mt at a grade of 0.56% nickel and 0.34% copper (LionOre Mining International Ltd., 2002§).

Gold.—Gallery Gold Limited of Australia, in which Lion Selection Group Limited of Australia held a 43% interest, held a significant land position in the Tati and Vumba Greenstone Belts in eastern Botswana. Although the Mupane gold deposit, which is located about 30 km southwest of Francistown, was its most advanced prospect, Gallery was also exploring the Tekwane area near the Selkirk Mine for platinum, nickel, and kimberlite pipes. A positive prefeasibility study on the Mupane gold deposit was completed in early 2002. Capital costs for the development of the Mupane gold project were estimated to be $25 million. The study proposed two open pits at Kwen and Tau with additional mill feed coming from the nearby Signal Hill gold deposit. The study proposed two plant sizes of 750,000 t/yr of ore feed and one treating 1 Mt/yr. Gold recovery would range from 3,110 to 3,732 kilograms per year of gold depending on mill size. Ore reserve drilling was completed in September 2001; results were expected by December 2002. Gallery anticipated that reserves would be about 21,800 kg of gold and was continuing exploration to identify an additional 6,200 kg of gold resources. The final feasibility study was expected to be completed by March 2003 with the first gold pour anticipated by July 2004 (Lion Selection Group Limited, 2002§).

Another Australian junior Tawana Resources NL was evaluating the alluvial deposit at Somerset, which is located in the Vumba Greenstone Belt near Francistown. Studies indicate a total mineral resource containing 1 Mt of superficial gravel. Tawana is carrying out several bulk samples to obtain an overall grade for the deposit. Previous workings reported an average grade of 2.85 grams per metric ton gold. Extensions of the Kraaipan Greenstone belt into southern Botswana from South Africa remain the focus of exploration by Ashanti Goldfields Corp. (MBendi Information Services (Pty) Ltd., 2002§).

Industrial Minerals

Diamond.—The major news of the year involved the delisting of De Beers Centenary AG (De Beers) in June from the Johannesburg Stock Exchange and its conversion to a privately owned company in a transaction valued at $19 billion. The restructured De Beers was owned by DB Investments (45%) (an Oppenheimer family consortium), Anglo American (45%), and the Government of Botswana (10%) (Namibia Economist, 2001§). During 2001, Debswana recovered 13,056,000 carats at an average value of $110 per carat from the Orapa Mine, 12,339,000 carats of diamond at an average value of $50 per carat from the Jwaneng Mine, and 1,021,000 carats at an average value of $180 per carat from the Letlhakane Mine (Terraconsult, 2002§). Sales of diamond from mine production and stocks declined slightly to 25,244 carats in 2001 compared with 25,737 carats in 2000. Production was sold through the De Beers Diamond Trading Company (formerly the Central Selling Organization). Debswana owned subsidiaries for diamond sorting and valuation (Botswana Diamond Valuing Co.) and for value-added cutting and polishing diamond (Teemane Manufacturing Co.). Diamond production will level off at between 26 million and 27 million carats per year after the full commissioning of Debswana's new Damtshaa Mine. The $38 million project will begin production in October 2002 with full production of around 700,000 carats per year of diamonds expected by March 2003. At the current design rate of 200 metric tons per hour of ore treated, the Damtshaa project life expectancy could be 32 years (Debswana Diamond Company, 2001§).

De Beers held a 60% interest in the Botswana Gope Exploration Company that discovered diamond at Gope in the Central Kalahari Game Reserve during the late 1990s. De Beers, which has abundant diamond resources in its other Botswana properties, placed the project on hold pending public

Digitized by Google

discussion on the aboriginal rights of local Bushmen tribesmen who live in the area and the environmental impact of mining in a game reserve (Mogapi, 2001§).

Salt and Soda Ash.—After having recovered from the disastrous floods, financial liquidation, and restructuring of the late 1990s, Botswana Ash (Botash) continued to operate its brine mining and treatment facility at Sua Pan, which is located 173 km northwest of Francistown. Recovering from the heavy rains of 2000, Botash increased production of soda ash by more than 31% to 251,231 t in 2001; production of salt declined to 178,646 t from 184,753 t in 2000. Botash pumped salt brines from nearly 100 wells to nearby large evaporation ponds at a rate of about 2,400 cubic meters per hour. More than 300 metric tons per day of carbon dioxide recovered from an associated coal cogeneration plant was used in carbonation of the brines to produce the soda ash. Finished products were railed to Francistown for shipment to markets in South Africa, Zambia, and Zimbabwe (Tassell, 2002§).

In February 2001, the South Africa Competition Commission ruled in favor of Botash in a long-standing trade dumping case against the America Natural Soda Ash Corp. (Ansac), which was a joint venture of a number of U.S. soda ash producers that were selling into the South Africa market. Botash claimed that Ansac was selling soda ash into South African markets below the price charged to U.S. consumers and that this contributed to the financial liquidation of its predecessor company in 1995. Ansac will appeal the ruling (Cohen, 2001§).

Mineral Fuels

Coal.—Morupule Colliery had a production capacity of about 1 Mt/yr. Between 1998 and 2001, it operated at a fairly consistent rate of 93% to 94% of capacity. Most of its output fed the nearby Botswana Power Corp. thermal powerplant at Morupule, which supplied more than 50% of Botswana's electricity requirements, or about 1,060 kilowatthours of energy. Other customers included the nickel and soda ash companies. The coal that was extracted underground from a 12-foot seam by using mechanized room-and-pillar-mining was sent to the surface on shuttle cars on an inclined ramp and was then conveyored to the Morupule powerplant. Reserves in the Morupule field were estimated to be 8 billion metric tons of steam coal with 18% to 24% ash and a calorific value of 23 to 25 megajoules per kilogram (Ministry of Minerals, Energy and Water Affairs, 1999§; Debswana Diamond Company, 2002§).

Infrastructure

Transportation facilities were good on the eastern fringe of the country. The 850-km trans-Kalahari highway connected Gaborone, Botswana, to Gobabis, Namibia. Highways also connected landlocked Botswana with South Africa and Zimbabwe. A single-track railroad, which was operated by Botswana Railways, runs from north to south through the eastern part of the country and connects with the South African and the Zimbabwean rail systems. During 2001, additional investment on water and power infrastructure was made by Tati as part of its Phoenix Mine expansion.

Outlook

Revenues from diamond mining and cutting are expected to continue to be the mainstay of the economy for the foreseeable future with Debswana's identified diamond resources sufficient to maintain 2001 production levels for at least 25 to 30 years. Production of nickel and copper, which is the jointly mined commodities that earned the second largest amount of foreign exchange, have a more limited life and are expected to continue to be around 25,000 to 30,000 t/yr of nickel until the expected end-of-life of the BCL Ltd. operations at Pikwe-Selebi in 2011; the mine life of the Tati nickel operations is projected to last until at least 2017. The country's favorable geologic environment, mineral investment climate, political stability, and low tax rates are expected to continue to make Botswana a target for foreign mineral investment. Incentives provided in the new Mining Law of 1999 were aimed at helping the Government diversify the national economy and reduce its reliance on the diamond industry.

Reference Cited

Murray, Roger, 2002, Botswana, *in* Mining annual review 2002: London, United Kingdom, Mining Journal Ltd. CD-ROM.

Internet References Cited

Anglo American plc, 2002 (March 13), Reserves and resources, Annual Report, accessed November 28, 2002, at URL http://www.angloamerican.co.uk/investor/downloads/Report_2001_Final.pdf.

Cohen, Tim, 2001 (February 27), United States found to be contravening South Africa competition laws, Glassbytes, accessed June 18, 2001, at URL http://glassbytes.com/022701africa.htm.

Debswana Diamond Company, 2001 (January 31), Damtshaa Mine on target, Press Release, accessed November 22, 2002, at URL http://www.debswana.com/archive/mediareleases/mr20020131-1.asp.

Debswana Diamond Company, 2002, Investments—Morupule Colliery, accessed November 22, 2002, at URL http://www.debswana.com/investments/invMoruoule.asp.

International Monetary Fund, 2002 (November), Botswana—Selected issues and statistical appendix, IMF Staff Country Report No. 02/243, accessed November 20, 2002, at URL http://www.imf.org/external/pubs/cat/longres.cfm?sk=16162.0.

Joint United Nations Programme on HIV/AIDS, 2002 (July), Report on the global HIV/AIDS epidemic, accessed July 3, 2002, at URL http://www.unaids.org/epidemic_update/report_july02/index.html.

LionOre Mining International Ltd., 2002 (May 15), Annual report for 2001, accessed December 5, 2002, at URL http://www.lionore.com/files/financials.asp.

Lion Selection Group Limited, 2002, Annual report for the year ended 31 July 2002, accessed December 5, 2002, at URL http://www.lionselection.com.au/rep_ann.html.

MBendi Information Services (Pty) Ltd., 2002 (October 25), Gold mining, Botswana—Mining, accessed November 30, 2002, at URL http://www.mbendi.co.za/indy/ming/gold/af/bo/p0005.htm.

Ministry of Minerals, Energy and Water Affairs, 1999 (December), Mining investment opportunities in Botswana, accessed June 18, 2001, via URL http://www.gov.bw/government/ministry_of_minerals_energy_and_water_affairs.html#mineral_promotion.

Mogapi, Spencer, 2001 (June 14), Confusion over Botswana diamond mining in game park, Botswana Gazette, accessed November 30, 2002, at URL http://www.afrol.com/News2001/bot009_mining_park.htm.

Namibia Economist, 2001 (May 23), De Deers buyout gets go-ahead, accessed November 22, 2002, at URL http://www.economist.com.na/2001/230501/story4.htm.

News Africa.com, 2001, Botswana mining—Botswana mining act, accessed June 15, 2001, at URL http://www.newafrica.com/mining/laws/countries.asp?countryID=7).

Digitized by Google

Tassell, Arthur, 2002 (November-December), Botash—No flash in the pan, African Mining, accessed January 6, 2003, at URL http://www.mining.co.za/DataResult.asp?IdNo=245).
Terraconsult, 2002, World natural diamond production—2001, accessed August 12, 2002, at URL http://www.terraconsult.be/overview.htm.

Major Sources of Information

Ministry of Minerals, Energy and Water Affairs
Private Bag 0018
Gaborone, Botswana
Telephone: (267) 365-6600
Fax: (267) 372-738
Department of Mines
Private Bag 0049
Gaborone, Botswana
Telephone: (267) 365-7000
Fax: (267) 352-141
Department of Geological Survey
Private Bag 0014
Lobatse, Botswana
Telephone: (267) 330-327
Fax: (267) 332-013

Major Publications

Botswana Department of Mines:
Mineral Development and Investment Opportunities
Annual Report
Carney, J.M., Aldiss, D.T., and Lock, N.P., 1994, The geology of Botswana: Gaborone, Botswana, Geology Survey Department, 113 p.

TABLE 1
BOTSWANA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1997	1998	1999	2000	2001
Coal, bituminous		776,920	928,100	945,316	946,900	930,374
Cobalt, smelter output, Co content of matte 3/ 4/		334	335	331	308	325
Copper:						
Mine output, Cu content of ore milled		22,840	25,043	37,604	22,218	20,355
Smelter output, Cu content of matte 3/ 4/		19,820	22,124	20,960	18,722	19,209
Diamond 5/	thousand carats	20,111	19,772	22,898	24,635	26,416
Gemstones, semiprecious 6/	kilograms	54,000	38,000 3/	84,000	80,000 e/	80,000 e/
Gold 7/	do.	28	1	2	4	2
Nickel:						
Mine output, Ni content of ore milled		19,860	21,700	33,733	20,286	18,585
Smelter output, matte, gross weight 3/		50,570	56,732	60,500	48,420	50,999
Smelter output, Ni content of matte 4/		20,157	22,851	22,898	21,446	22,454
Salt 8/		184,530	214,700	233,069	184,753	178,646
Sand, construction 9/	cubic meters	110,000	90,000 e/	90,000	100,000 e/	150,000 e/
Soda ash, natural		199,990	189,700	233,643	191,043	251,231
Stone, crushed	cubic meters	1,091,880	997,244	1,466,100	1,070,000	2,140,523

e/ Estimated.
1/ Table includes data available through October 2002.
2/ In addition to commodities listed, clay (for brick and tile) and silver were produced, but information was inadequate to estimate output.
3/ Smelter product was granulated nickel-copper-cobalt matte.
4/ Included some product from direct smelting ore; that is, ore not reported as milled.
5/ Assumed to contain about 70% gem and near gem.
6/ Principally agate. Reported as sales.
7/ Reported as bullion; historically included silver estimated to be about 2%.
8/ From natural soda ash production.
9/ Additional production of sand and gravel from small local operations was periodically reported, but information was inadequate to estimate output.

Source: U.S. Geological Survey Minerals Questionnaire for 2000-2001, prepared by Botswana Department of Mines.

Digitized by Google

TABLE 2
BOTSWANA: STRUCTURE OF THE MINERAL INDUSTRY IN 2001

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Clay 1/		Lobatse Clay Works (Proprietary) Ltd. (Botswana Development Corp. and Interkiln Corp. joint venture)	Lobatse, 70 kilometers south-southwest of Gaborone	50,000. e/
Do.		Makoro Brick and Tile (Proprietary) Ltd.	Makoro, 10 kilometers south of Palapye	20,000. e/
Coal		Morupule Colliery (Proprietary) Ltd. (Anglo American Corp. of South Africa Ltd. and related firms, 93.3%)	Morupule, 270 kilometers northwest of Gaborone	1,000,000.
Cobalt 2/		BCL Ltd., (Government, 15%; and Botswana RST Ltd., 85%, of which Anglo American plc, 12.65%)	Selebi-Phikwe, 350 kilometers northeast of Gaborone	500.
Copper 2/		do.	do.	26,000.
Copper ore		do.	do.	1,800,000.
Do.		Tati Nickel Mining Co. (Proprietary) Ltd. (Anglo American plc, 43.35%; LionOre Mining International Ltd., 41.65%; and Government, 15%)	Selkirk Mine, 23 kilometers east of Francistown and Phoenix Mine, near Francistown	1,560,000. 3/
Diamond	thousand carats	Debswana Diamond Co. (Proprietary) Ltd. (Government, 50%; De Beers Centenary AG, 50%)	Jwaneng Mine, 115 kilometers west of Gaborone	12,000.
Do.	do.	do.	Orapa Mine, 375 kilometers north of Gaborone	13,000.
Do.	do.	do.	Letlhakane Mine, 350 kilometers north of Gaborone.	1,000.
Do.	do.	do.	Damtshaa Mine (opens 2003)	670.
Do.	do.	Tswapong Mining Co. (Proprietary) Ltd. (De Beers Prospecting Botswana Ltd., 85%, Government, 15%)	Tswapong Mine, 275 kilometers northeast of Gaborone	3.
Gemstones, semiprecious	kilograms	Agate Botswana (Proprietary) Ltd.	Processing plant at Pilane, 45 kilometers north of Gaborone	60,000.
Do.	do.	Masa Precious Stones (Proprietary) Ltd.	Bobonong, east of Selebi-Phikwe	4,000.
Nickel 2/		BCL Ltd., (Government, 15%; Botswana RST Ltd., 85%)	Selebi-Phikwe, 350 kilometers northeast of Gaborone	23,000.
Nickel ore		do.	do.	1,800,000.
Do.	million metric tons	Tati Nickel Mining Co. (Proprietary) Ltd. (Anglo American plc, 43.35%; LionOre Mining International Ltd., 41.65%; and Government, 15%)	Phoenix open pit Mine (2003 expansion to 3.6 million metric tons of ore)	1.7 ore. 4/
Do.		do.	Selkirk UG Mine, Francistown (scheduled to close early 2002)	60,000. 5/
Salt		Botswana Ash (Proprietary) Ltd. (Government, 50%; Anglo American Corp. of South Africa Ltd., 50%)	Sua Pan, 450 kilometers north of Gaborone	650,000.
Soda ash		do.	do.	300,000.

e/ Estimated.
1/ For brick and tiles.
2/ In nickel-copper-cobalt smelter matte.
3/ Copper content estimated to be 1.5%.
4/ Phoenix Mine ships about 100,000 tons per year of concentrate at a grade of about 5.5% nickel.
5/ Direct smelting ore grading about 2.6% nickel.

Digitized by Google

Digitized by Google

THE MINERAL INDUSTRIES OF

BURKINA FASO, MALI, MAURITANIA, AND NIGER

By Philip A. Szczesniak

BURKINA FASO

In 2001, the mineral sector played a minor role in Burkina Faso's economy with some production of cement, gold, pumice, salt, and stone. Other mineral resources included antimony, bauxite, copper, lead, magnetite, manganese, nickel, phosphate, silver, and zinc. The gross domestic product (GDP) was estimated on the basis of purchasing power parity to be $13.98 billion in 2001; the leading industries were agriculture and services. Burkina Faso's population was estimated to be 11.3 million in 2001 (World Bank, 2001a§[1]; International Monetary Fund, 2002§).

The Government agency responsible for mining is the Ministère de l'Énergie et Mines. In 1997, the Government adopted a new Mining Code with two primary objectives—to standardize all the legal measures that are used to regulate the mining sector and to amend those parts of the previous legislation that had proved inadequate and hindered future mining development. Other provisions of the 1997 Mining Code were as follows: to prevent the state from holding sole ownership of a mining title, to ensure that an exploration permit confers the automatic right for the holder to apply for a mining permit for deposits discovered within the exploration area concerned, to require a mining permit holder to begin production within 2 years of the permit being granted, and to retain a 10% free-carried state interest in the project (Mining Journal, 2000a).

In 2001, Governments of seven countries in Western Africa agreed to form a free trade zone. The countries included Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali, Niger, and Nigeria. According to Burkina Faso's Minister of Co-operation and Integration in Africa, the agreement will work toward expanding the economic and infrastructural development in the region (Guardian Online, 2001§).

Numerous mining companies had gold interests in Burkina Faso in 2001; however, production was only from artisanal miners. Among the companies exploring were Ashanti Goldfields Company Ltd. of Ghana, Channel Resources Ltd. of Canada, Cluff Mining plc of the United Kingdom, Coronation International Mining Corp. of Canada, Delta Gold Ltd. of Australia, Echo Bay Mines Ltd. of Canada, High River Gold Mines Ltd. of Canada, Orezone Resources, Inc., of Canada, Randgold Resources Ltd. of the United Kingdom, Resolute Mining Ltd. of Australia, Semafo, Inc., of Canada, and Solomon Resources Ltd. of Canada. Artisanal miners produce about 1,000 kilograms per year (kg/yr) of gold [Mbendi Information Services (Pty.) Ltd., 2001a§].

In 2001, Metorex Ltd. of South Africa announced that it had agreed to a memorandum of understanding (MOU) with the Government of Burkina Faso regarding its 90% holding in the Perkoa zinc deposit; the Government of Burkina Faso owned the remaining 10%. The MOU allowed Metorex to proceed with a final feasibility study and to continue discussions with stakeholders and international aid agencies regarding funding for infrastructure requirements, such as roads, power, and water supply. Perkoa, which is in western Burkina Faso, is a high-grade zinc ore deposit still in development with resources of 7 million metric tons (Mt) at a grade of 17.6% zinc at a cutoff grade of 10% zinc. Planned production levels are 60,000 metric tons per year (t/yr) of zinc with an estimated mine life of 15 years (Metorex Ltd., 2000§, undated§).

During 2001, the African Development Bank Group approved two different loans totaling nearly $50 million to encourage economic development in Burkina Faso, a country considered to be one of the poorest in the world. In April, a $19 million loan was approved to finance the Decentralized and Participatory Rural Development Project in Bazega and Kadiogo Provinces. Two goals of the project were to establish an environmental observatory and to increase agricultural and livestock production by performing such activities as soil improvement on 1,900 hectares of clay and development of many hectares of land for irrigated rice and other crops. In October, a $29.76 million loan was approved to finance the Poverty Reductions Strategy Support Program. Goals of this project include strengthening the bases for growth and competitiveness, the rationalization and decentralization of public expenditures, compliance with financial accountability, and implementation of an efficient monitoring and evaluation system (African Development Bank Group, 2001a§, b§).

MALI

Mali's mineral sector was dominated by gold mining, and in early 2001, the country became the third largest gold producer in Africa after South Africa and Ghana. Mali also produced some cement, gypsum, salt, and silver. Other mineral resources included bauxite, iron ore, diamond, limestone, manganese, nickel, petroleum, phosphates, tin, and uranium. The GDP was estimated on the basis of purchasing power parity to be about $9.82 billion in 2001; the leading industries were agriculture and services. Exports in 2001 were $518 million; gold exports

[1]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

of $287 million accounted for about 55% of all exports. Mali's population was estimated to be 10.8 million in 2001 (World Bank, 2001b§; International Monetary Fund, 2002§).

The Government agency responsible for mining is the Direction Nationale de la Géologie et des Mines, which is part of the Ministère des Mines, de l'Énergie et de l'Hydraulique. In recent years, the Government revised its Mining Code by making changes to taxes and mining permits. The tax on sales by mining companies was reduced to 3% from 6%; the tax on proceeds from the transfer of shares in mining companies was reduced to 10% from 20%; and the tax on vehicle insurance for vehicles used on mining sites was eliminated. The length of tenure for medium-scale mining permits was extended to 3 from 2 years, and a 4-year permit was introduced for small-scale mining (Direction Nationale de la Géologie et des Mines, 2000; Mining Journal, 2000b).

In 2001, gold production increased by almost 50% to about 44,000 kilograms (kg) from nearly 31,000 kg in 2000 (both years include production of 2,000 kg/yr by artisanal miners). Six significant gold deposits were either in production or in a development stage in Mali (table 3). In 2001, the deposits were, in decreasing order of production, Morila, Sadiola Hill, Yatela, and Syama. Deposits that were in the development stage were, in decreasing order of their resources, Loulo and Segala.

The Morila open pit gold mine, 180 kilometers (km) southeast of Bamako, was officially opened in early 2001 by the President of Mali. After completing its first full year of production in 2001, more than 19,600 kg (reported as 631,650 ounces) of gold was produced by the consortium of Anglogold Ltd. (40%), Randgold Resources Ltd. (40%), and the Government (20%). The mine was expected to yield, on average, about 14,000 kg/yr of gold through 2012 (Randgold Resources Ltd., 2001, p. 18).

The Sadiola Hill open pit gold mine, 80 km southwest of Kayes, produced almost 16,700 kg (536,047 ounces) of gold in 2001. The mine was operated by Société d'Exploration des Mines d'Or de Sadiola S.A. [a consortium made up of Anglogold Ltd. of South Africa (38%), IAMGOLD Corp. of Canada (38%), the Government of Mali (18%), and the World Bank's International Finance Corporation (6%)]. The mine was expected to yield on average about 12,000 kg/yr of gold through 2010 (IAMGOLD Corp., 2001, p. 3).

The Yatela open pit gold mine, 60 km southwest of Kayes and 25 km north of the Sadiola Hill Mine, produced 4,073 kg (130,948 ounces) of gold in 2001; production began in May 2001. The mine was owned by a consortium made up of Anglogold (40%), IAMGOLD (40%), and the Government of Mali (20%). The mine was to produce about 7,250 kg/yr during a 6-year period to yield about 43,500 kg (1.4 million ounces) of gold (IAMGOLD Corp., 2001, p. 6).

The Syama open pit gold mine, 75 km southwest of Sikasso in southern Mali, closed in early 2001 and produced just 1,896 kg (60,953 ounces) of gold for the year. The mine was operated by Randgold (75%), the Government (20%), and the World Bank's International Finance Corporation (5%). In early 2001, operations were mothballed pending a return to higher gold prices. Syama has resources estimated to be about 160,000 kg (5.0 million ounces) of gold (Randgold Resources Ltd., 2001, p. 24).

Two additional notable gold deposits were also being examined for potential development in the near future. Randgold was developing the Loulo gold deposit, 220 km south of Kayes in western Mali, which has a resource estimated to be about 130,000 kg of gold. Company officials noted that the remote location of the Loulo deposit and the lack of infrastructure were significant obstacles that were delaying starting up a potential future mine at Loulo (Randgold Resources Ltd., 2001, p. 22). Semafo was developing the Segala gold deposit located near the Loulo deposit in western Mali. In July 2001, Semafo company officials reduced the resource estimates at Segala to 23,000 kg and noted that, although the resources were lowered, the deposit was graded higher than originally thought (Northern Miner, 2001).

Numerous other mining companies had gold interests in Mali in 2001. The following lists these companies and concessions they were exploring: African Metals Corp. of Canada owned the Duroussalam, Faraba, and Lenguekoto concessions; Axmin, Inc., of Canada owned the Kofi concession; Etruscan Resources, Inc., of Canada owned the Djelimangara, Kolomba, Mogoyafara, and Sanoukou concessions; Great Quest Metals Ltd. of Canada owned the Bourdala and Kenieba concessions; the Republic of Korea's Hyundai Corp. owned the Barani East, Linnguekoto West, and Sepola concessions; Maurel & Prop, Inc., of France owned the Banankoro concession; Moydow Mines International, Inc., of Canada owned concessions in southern Mali; Nevsun Resources Ltd. of Canada owned the Tabakoto concession; Orezone owned the Kantela concession; and Robex Resources, Inc., of Canada owned the Diagounté concession.

In August 2001, the Manantali hydroelectric power station in Senegal was expected to begin supplying power to Mali. The power station consists of four 40 megawatt generators and was expected to produced 800 million kilowatthours per year with 55% going to Mali; 30%, to Senegal; and 15%, to Mauritania. The three countries are members of the Organisation pour la Mise en Valeur du Fleuve Senegal (the Senegal River Basin Development Organization) (Africa Energy Intelligence, 2001a).

MAURITANIA

Mauritania's mineral sector was dominated by iron ore mining and beneficiation in 2001. Mauritania also produced cement, gypsum, petroleum refinery products, and salt. Other mineral resources included copper, diamond, gold, ilmenite, manganese, phosphate, and uranium. The GDP was estimated on the basis of purchasing power parity to be about $5.52 billion in 2001; the leading industries were agriculture and services. Exports in 2001 were $345 million; iron exports of $193 million accounted for about 56% of all exports. Mauritania's population was estimated to be 2.7 million in 2001 (World Bank, 2001c§; International Monetary Fund, 2002§).

The Ministère des Mines et de l'Industrie is the Government agency responsible for the mining industry in Mauritania. In 2000, it appointed the Council for Geoscience in South Africa to provide technical supervision and advice to the Projet de Reinforcement Institutionelle de Secteur Minier (PRISM). The PRISM is a 5-year program intended to accelerate the growth of

Digitized by Google

the Mauritanian mining sector with a $16.5 million loan from the International Development Association of the World Bank. Projects include the production of a 1:500,000-scale geologic map of the nation and 1:200,000-scale maps of areas with mineral potential. The PRISM began in September 2000 and was scheduled to run until 2004 (Mining Journal, 2000c).

In 1999, the Ministère des Mines et de l'Industrie adopted a new decree that outlined the rules concerning mining titles in the Mauritanian Mining Code. The Decret Portant sur les Titres Miniers (law No. 99/013) established four types of licenses for prospecting, exploration, exploitation, and small-scale mining exploitation [Mbendi Information Services (Pty.) Ltd., 2002§].

Société Nationale Industrielle et Minière (SNIM) was responsible for iron ore production and beneficiation. SNIM operated three open pit iron ore mines at Guelb El Rhein, Kedia d'Idjill, and M'Haoudat, all in the Tiris region in northern Mauritania. In 2001, about 10.3 Mt of iron ore was produced, most of which was exported to Belgium, France, and Italy. In October, Sphere Investments Ltd. of Australia entered into a joint venture with SNIM to develop the Guelb el Aouj deposits that contain an estimated 500 Mt of magnesite; the deposits are in northern Mauritania about 35 km from existing iron ore operations. Sphere was entitled to earn 20% in the project if it invests $1 million in the first phase of a three-phase bankable feasibility study and can earn an additional 30% if it invests $10 million in the second and third phases [Metal Bulletin, 2001; Mbendi Information Services (Pty.) Ltd., 2001b§].

In 2001, the Guelb Moghrein project, which was being developed by Guelb Moghrein Mines d'Akjoujt S.A. of Mauritania, was put up for sale. The project, which is within mining concession CM2 at Akjoujt, contains an estimated 2,600 metric tons (t) of cobalt, 328,000 t of copper, and about 25,700 kg (827,000 ounces) of gold (Africa Mining Intelligence, 2001).

Diamond exploration was among the principal exploration activities that took place in 2001. BHP Billiton plc of Australia, De Beers Consolidated Mines Ltd. of South Africa, Rex Diamond Mining Corporation of Canada, and Rio Tinto plc of the United Kingdom were actively exploring for diamond in northern Mauritania. In March, Rex Diamond Mining announced the discovery of another 3 kimberlite deposits in Mauritania, thus bringing the total found on its properties to 20; of these, 12 have been sampled with 5 that yield diamond (Mining Journal, 2001).

Several international oil companies were involved in offshore oil exploration in Mauritania in 2001. In May, a consortium led by Eni of Italy, Hardman Resources NL of Australia, and Woodside Petroleum Ltd. of Australia announced the discovery of oil at the Chinguetti-1 well. Reserves were initially estimated to be 65 million barrels (Africa Energy Intelligence, 2001b; Rigzone.com, 2002§). Other companies exploring for oil offshore were Dana Petroleum plc of the United Kingdom, Fusion Oil & Gas plc of Australia, and Roc Oil Ltd. of Australia.

NIGER

Niger's mineral sector was dominated by uranium mining in 2001. Niger also produced cement, coal, gold, gypsum, molybdenum, salt, and tin. Other mineral resources included iron ore, phosphate, and petroleum. The GDP was estimated on the basis of purchasing power parity to be about $10.28 billion in 2001; the leading industries were agriculture and services. Exports in 2001 were $253 million; uranium exports of $90 million accounted for about 35% of all exports. Niger's population was estimated to be 10.8 million in 2001 (World Bank, 2001d§; International Monetary Fund, 2002§).

The Government agency responsible for mining is the Ministry of Mines and Energy. In 2000, the Government announced an offering of four oil exploration blocks with a number of tax exemptions. The exemptions included a complete waiver on taxes during the exploration phase; an exemption from duties and import tax on material, supplies, equipment, and spares for oil operations; a waiver on taxes on bank loans; free import and export of oil products; and tax-free currency exchange and transfers. Once production begins, royalties will amount to 12.5% on oil and 5% on gas, and the corporate tax rate will be set at 45%. Exploration permits will be awarded for a 4-year period and will be renewable twice for periods of 3 years apiece. In the case of a commercial discovery, a concession will be awarded for 15 years and will be renewable for one additional 15-year period (Africa Energy Intelligence, 2000).

During 2001, construction continued on the open pit Samira Hill gold mine, 90 km west of the capital of Niamey; a 7-million-cubic-meter water dam and a 7-km pipeline and pumping station were built. Capital costs for the entire mine were estimated to be $26 million. Production was expected to begin by the end of 2002 with about 4,200 kg of gold expected to be produced in the first year of production; mining reserves were 22,300 kg (reported as 10 Mt at a grade of 2.23 grams per metric ton gold) to be mined during a 7-year period. The mine was owned by African GeoMin Mining Development Corporation Ltd. of Niger [a consortium of Etruscan (40%), Semafo (40%), and the Government of Niger (20%)] (Semafo, Inc., undated§).

In 2001, Niger was the world's third largest producer of uranium after Canada and Australia (Uranium Information Centre Ltd., 2002§). Niger has two main uranium producing mines, the Akouta underground mine and the Arlit open pit mine, both in northern Niger. Société des Mines de l'Aïr [Cogema of France (63.4%) and Nigerien Government (36.6%)] operated both mining operations that together produced 3,096 t of uranium in 2001, an increase of 201 t from 2,895 t in 2000. Production costs have been high for these two mines, and uranium products are purchased under special agreements between the Nigerien Government and customers in France and Japan [Mbendi Information Services (Pty.) Ltd., 2001c§].

References Cited

Africa Energy Intelligence, 2000, Niger—Tax exemptions: Africa Energy Intelligence, no. 287, November 22, p. 7.

Africa Energy Intelligence, 2001a, Mali/Senegal—Manantali soon operational: Africa Energy Intelligence, no. 295, March 21, p. 6.

Africa Energy Intelligence, 2001b, Mauritania—Offshore discovery for Australian firm: Africa Energy Intelligence, no. 300, June 6, p. 5.

Africa Mining Intelligence, 2001, Mauritania—Guelb Moghrein up for grabs: Africa Mining Intelligence, no. 18, July 11, p. 3.

Digitized by Google

Direction Nationale de la Géologie et des Mines (Mali), 2000, Commerce de l'or—La fluctuation du cours et ses effets: Infomines, no. 00, p. 9-10.
IAMGOLD Corp., 2001, Annual report: Markham, Ontario, Canada, IAMGOLD Corp., 42 p.
Metal Bulletin, 2001, SNIM signs joint venture to study El-Aouj deposit: Metal Bulletin, no. 8620, p. 18.
Mining Journal, 2000a, Burkina Faso: Mining Journal Supplement, November, 12 p.
Mining Journal, 2000b, Mali, *in* Mining annual review 2000: London, United Kingdom, Mining Journal Ltd. CD-ROM.
Mining Journal, 2000c, PRISM bids to improve Mauritanian exploration: Mining Journal, v. 335, no. 8594, August 4, p. 89.
Mining Journal, 2001, More Mauritanian kimberlites for Rex: Mining Journal, v. 336, no. 8627, March 30, p. 233.
Northern Miner, 2001, Semafo reduces resource: Northern Miner, July 23-29, p. 16.
Randgold Resources Ltd., 2001, Annual report: St. Helier, United Kingdom, Randgold Resources Ltd., 75 p.

Internet References Cited

African Development Bank Group, 2001a (April 18), The African Development Fund approves a $19 million loan to finance the decentralized and participatory rural development project in Bazega and Kadiogo provinces in Burkina Faso, accessed August 14, 2002, at URL http://www.afdb.org/knowledge/loans2001/adf_decentralized_burkina_faso.htm
African Development Bank Group, 2001b (October 10), The African Development Fund approves a $29.76 million loan to finance the poverty reduction strategy support program in Burkina Faso, accessed August 14, 2002, at URL http://www.afdb.org/knowledge/pressreleases2001/adf_65_2001e.htm.
Guardian Online, 2001 (November 6), Nigeria, six others form free trade zone, accessed April 12, 2002, at URL http://www.ngrguardiannews.com/news2/nn838705.html.
International Monetary Fund, 2002 (April), World economic outlook database, accessed June 12, 2002, at URL http://www.imf.org/external/pubs/ft/weo/2002/01/data.
Mbendi Information Services (Pty.) Ltd., 2001a (April 25), Burkina Faso—Mining—Gold mining, accessed June 8, 2001, at URL http://www.mbendi.co.za/indy/ming/gold/af/bf/p0005.htm.
Mbendi Information Services (Pty.) Ltd., 2001b (October 30), Mauritania—Mining—Iron ore mining, accessed February 28, 2002, at URL http://www.mbendi.co.za/indy/ming/iron/af/mu/p0005.htm.
Mbendi Information Services (Pty.) Ltd., 2001c (October 30), Niger—Mining—Uranium mining, accessed February 28, 2002, at URL http://www.mbendi.co.za/indy/ming/urnm/af/ni/p0005.htm.
Mbendi Information Services (Pty.) Ltd., 2002 (February 19), Mauritania—Mining, accessed February 28, 2002, at URL http://www.mbendi.co.za/indy/ming/au/mu/p0005.htm.
Metorex Ltd., 2000 (December 14), Metorex poised to enhance delivery, Press Release, accessed February 6, 2001, at URL http://www.metorexgroup.com/pr7.htm.
Metorex Ltd., [undated], Metorex Burkina Faso, accessed August 14, 2002, at URL http://www.metorexgroup.com/PerkoaZincProj.htm.
Rigzone.com, 2002 (May 9), Woodside to drill more wells offshore Mauritania, accessed August 29, 2002, at URL http://www.rigzone.com/news/article.asp?a_id=3297.
Semafo, Inc., [undated], Operations—Niger—Samira Hill project, accessed August 29, 2002, at URL http://www.semafo.com/operations_niger.html.
Uranium Information Centre Ltd., 2002 (July), World uranium mining, Nuclear Issues Briefing Paper 41, accessed August 29, 2002, at URL http://www.uic.com.au/nip41.htm.
World Bank, 2001a (October 9), Burkina Faso at a glance—2000, accessed February 28, 2002, via URL http://www.worldbank.org/data/countrydata/countrydata.html#AAG.
World Bank, 2001b (September 29), Mali at a glance—2000, accessed February 28, 2002, via URL http://www.worldbank.org/data/countrydata/countrydata.html#AAG.
World Bank, 2001c (October 17), Mauritania at a glance—2000, accessed February 28, 2002, via URL http://www.worldbank.org/data/countrydata/countrydata.html#AAG.
World Bank, 2001d (October 9), Niger at a glance—2000, accessed February 28, 2002, via URL http://www.worldbank.org/data/countrydata/countrydata.html#AAG.

Major Sources of Information

Burkina Faso Ministère de l'Énergie et des Mines
01 B.P. 644
Ougadougou, Burkina Faso
Telephone: (226) 32-84-29
Fax: (226) 32-84-30

Bureau des Mines et de la Géologie du Burkina
01 B.P. 601
Ougadougou, Burkina Faso
Telephone: (226) 36-48-02
Fax: (226) 32-48-88

Mali Direction Nationale de la Géologie et des Mines
B.P. 223
Bamako, Mali
Telephone: (223) 224-184, (223) 225-821
Fax: (223) 222-160, (223) 229-111

Mali Société Nationale de Recherches et d'Exploitation des Ressources Minières du Mali
B.P. 2
Kati (Bamako), Mali
Telephone: (223) 224-184, (223) 272-049
Fax: (223) 222-160, (223) 272-042

Mauritania Ministère des Mines et de l'Industrie
B.P. 199
Nouakchott, Mauritania
Telephone: (222) 25-30-83
Fax: (222) 25-69-37

Mauritania Projet de Renforcement Institutionnel du Secteur Minier
B.P. 4530
Nouakchott, Mauritania
Telephone: (222) 29-32-40
Fax: (222) 25-68-61

Niger Ministère des Mines, de l'Industrie et de la Technologie
B.P. 11700
Niamey, Niger
Telephone: (227) 73-45-82
Fax: (227) 73-28-12

Niger Office National des Ressources Minières
B.P. 12716
Niamey, Niger
Telephone: (227) 73-59-25
Fax: (227) 73-28-12

Digitized by Google

TABLE 1
BURKINA FASO, MALI, MAURITANIA, AND NIGER: ESTIMATED PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000	2001
BURKINA FASO 3/						
Cement	thousand metric tons	40,000	40,000	50,000	50,000	50,000
Gold	kilograms	1,089 4/	1,091 4/	886 4/	1,000	1,000
Manganese, Mn content of ore		1,000	1,000	--	--	--
Pumice and related volcanic materials		10,000	10,000	10,000	10,000	10,000
Salt		5,000	5,000	5,000	5,000	5,000
Stone, marble		100,000	100,000	100,000	100,000	100,000
MALI 5/						
Cement, hydraulic		30,000 r/	40,000 r/	30,000 r/	30,000 r/	40,000
Gold, mine output, gold content 6/	kilograms	16,323 4/	20,562 4/	23,690 4/	28,717 r/ 4/	42,288 4/
Gypsum		100	500	500	500	500
Salt		5,000	6,000	6,000	6,000	6,000
MAURITANIA 7/						
Cement		80,000	100,000 r/	100,000 r/	110,000 r/	110,000
Gypsum		80,000	100,000	100,000	100,000	100,000
Iron ore:						
Gross weight	thousand metric tons	11,703 8/	11,373 8/	10,401 8/	11,450 8/	10,300
Iron content	do.	7,605 4/	7,410 4/	7,475 4/	7,500	7,300
Petroleum refinery products:						
Liquefied petroleum gas	thousand 42-gallon barrels	440	440	440	440	440
Gasoline	do.	1,900	1,900	1,900	1,900	1,900
Kerosene	do.	470	470	470	470	470
Distillate fuel oil	do.	1,100	1,100	1,100	1,100	1,100
Residual fuel oil	do.	2,450	2,450	2,450	2,450	2,450
Other	do.	700	700	700	700	700
Total	do.	7,060	7,060	7,060	7,060	7,060
Salt		5,500	5,500	5,500	5,500	5,500
NIGER 9/						
Cement, hydraulic		30,000	30,000	30,000	40,000	40,000
Coal, bituminous		150,000	145,000	168,000 4/	158,000 4/	160,000
Gold	kilograms	1,000	1,000	1,000	1,000	1,000
Gypsum		1,800	2,000	1,502 4/	1,474 4/	1,500
Molybdenum concentrate, Mo content		10	10	10	10	10
Salt		3,000	2,000	2,000	2,000	2,000
Tin, mine output, Sn content		10	10	32 4/	22 4/	20
Uranium, U content		3,497 4/	3,731 4/	2,916 4/	2,895 r/ 4/	3,096 4/

r/ Revised. -- Zero.

1/ Table includes data available through August 29, 2002.

2/ Estimated data are rounded to no more than three significant digits; may not add to totals shown.

3/ In addition to the commodities listed, granite, phosphate rock, sand and gravel, and other construction material are produced, but information is inadequate to make reliable estimates of output levels.

4/ Reported figure.

5/ In addition to the commodities listed, Mali produced clays, and and gravel, and stone for local construction purposes in addition to diamond, marble, silver, and tin, but information is inadequate to make reliable estimates of output levels.

6/ Excludes artisanal production, estimated to be about 2,000 kilograms per year.

7/ In addition to the commodities listed, modest quantities of crude construction materials (clays, sand and gravel, and stone) presumably were produced, but output was not reported quantitatively. The minimill of Société Arabe de Fer et d'Acier en Mauritanie produced rebar and wire, but available information is inadequate to make reliable estimates of output levels.

8/ Reported by National Industrial and Mining Company.

9/ In addition to the commodities listed, phosphate rock, tungsten ore, and a variety of construction materials (clays, limestone, sand and gravel, and stone) were produced, but information is inadequate to make reliable estimates of output levels.

Digitized by Google

TABLE 2
BURKINA FASO, MALI, MAURITANIA, AND NIGER: STRUCTURE OF THE MINERAL INDUSTRIES IN 2001

(Metric tons, unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
BURKINA FASO				
Cement		Ciment du Burkina (Holcim Ltd. of Switzerland, 100%)	Ouagadougou Plant	200,000
MALI				
Cement		Diamou Cement (private, 100%)	Plant 45 kilometers west of Bamako	50,000
Do.		Société Lou Kouma (private, 100%)	Bamako Plant	236,000
Gold	kilograms	Société d'Exploration des Mines d'Or de Sadiola S.A. (Anglogold Ltd., 38%; IAMGOLD Corp., 38%; Government, 18%; World Bank, 6%)	Sadiola Hill Mine	20,000
Do.	do.	Anglogold Ltd., 40%; Randgold Resources Ltd., 40%; Government, 20%	Morila Mine	20,000
Do.	do.	Randgold Resources Ltd., 75%; Government, 20%; World Bank, 5%	Syama Mine 1/	6,000
Do.	do.	Anglogold Ltd., 40%; IAMGOLD Corp., 40%; Government, 20%	Yatela Mine	5,000
MAURITANIA				
Cement		Ciment de Mauritanie (private, 100%)	Nouakchott grinding plant	400,000
Gypsum		Société Arabe des Industries Métallurgiques [Société Nationale Industrielle et Minière (Government, 78%; private, 22%)]	Nouakchott Mine	100,000
Iron ore		Société Nationale Industrielle et Miniére	Mines in northern Mauritania	12,000,000
Petroleum products	thousand 42-gallon barrels	Société Mauritanienne d'Industrie de Raffinage	Nouadhibou Refinery	8,000
Salt		Société Mauritanienne des Industries du Sel	Lekhcheime Mines	5,500
NIGER				
Cement		Société Nigeriénne de Cimenterie (Holderbank, 77%; Government, 23%)	Malbaza Plant	40,000
Coal		Société Nigeriénne de Charbon d'Anour-Araren (Government, 100%)	Anour-Araren opencast operation	170,000
Gold	kilograms	Artisans	Liptako region	1,000
Salt		Sonisalt (Government, 100%)	Adebour and Tegguida n'tessoum	3,000
Uranium		Société des Mines de l'Aïr (Cogema, 63.4%; Government, 36.6%)	Arlit Mine	1,400
Do.		Compagnie Minière D'Akouta (Cogema, 34%; Government, 36.6%; Overseas Uranium Resources of Japan, 25%; Empresa National del Uranio of Spain, 10%)	Akouta Mine	2,000

1/ Closed in early 2001 owing to high production costs.

TABLE 3
SELECTED SIGNIFICANT GOLD DEPOSITS IN MALI IN 2001

Deposit	Company	Location	Production (kilograms)	Resources (kilograms)	Project life/status
Morila	Anglogold Ltd. (40%), Randgold Resources Ltd. (40%), Government of Mali (20%)	180 kilometers southeast of Bamako	19,647	184,000	Operations projected through 2012.
Sadiola Hill	Société d'Exploration des Mines d'Or de Sadiola S.A. [Anglogold Ltd. of South Africa (38%), IAMGOLD Corp. of Canada (38%), Government of Mali (18%), World Bank's International Finance Corp. (6%)]	80 kilometers southwest of Kayes	16,672	121,000	Operations projected through 2010.
Yatela	Anglogold Ltd. (40%), IAMGOLD Corp. (40%), Government of Mali (20%)	60 kilometers southwest of Kayes	4,073	50,000	Operations projected through 2007.
Syama	Randgold Resources Ltd. (75%), Government of Mali (20%), World Bank's International Finance Corp. (5%)	75 kilometers southwest of Sikasso	1,896	156,000	Closed in early 2001.
Loulo	Randgold Resources Ltd. and Government of Mali	220 kilometers southwest of Kayes	--	131,000	Development.
Segala	Semafo, Inc. (75%), and Government of Mali (25%)	do.	--	23,000	Do.

-- Zero.

Digitized by Google

BURUNDI, COMOROS, MALAWI, MAURITIUS, REUNION, RWANDA, AND SEYCHELLES

By Thomas R. Yager

BURUNDI

In recent years, Burundi, which is a small country in Central Africa, has been known to produce columbium (niobium)-tantalum ore, gold, kaolin, tin, and tungsten ore, most of which have been designated for export (table 1). The country has also been known to produce limestone, peat, and sand and gravel for domestic consumption. Additionally, Burundi has resources of cobalt, copper, feldspar, nickel, phosphate rock, platinum-group metals (PGM), quartzite, rare-earth elements (REE), uranium, and vanadium. More-extensive information on the mineral deposits in Burundi can be found in the 2000 Minerals Yearbook.

In 2001, Burundi's gross domestic product (GDP) amounted to about $4.7 billion at purchasing power parity, and the per capita GDP at purchasing power parity was about $700. Burundi's GDP increased by 2.4% in 2001 after falling by 0.1% in 2000 and by 1% in 1999. In 2001, manufacturing accounted for 5% of the GDP; construction, 4%; and mining and energy, about 1% (International Monetary Fund, 2002a, p. 7; 2002e, p. 174; 2002a§[1], b§; United Nations, 2002, p. 1).

In 2000, the Government introduced a new law aimed at increasing the output of artisanally mined minerals. The ad valorem tax on cassiterite, colombite-tantalite, and wolframite was cut to 3% from 7%, and on gold, to 0.3% from 0.75%. The export tax on wolframite was cut to 1% from 5%; on colombite-tantalite, to 2% from 5%; and on gold, to 0.2% from 1.5%. The export tax on cassiterite increased to 3% from 1%. Previously, the holder of an exploration/exploitation permit was required to post a bond of $60,000 and pay a fee of $50,000 per year. Under the new legislation, the bond is no longer required, and the license fee has been reduced to $10,000 per year (Songore, 2001).

In the northern Provinces of Kayanza and Kirundo, Comptoirs Miniers de Burundi S.A. (COMEBU) mined deposits of cassiterite, colombite-tantalite, and wolframite. COMEBU also sought joint-venture partners to exploit deposits of gold, kaolin, marble, nickel, phosphate rock, and rare earths. Tin output fell by 73% from 1997 to 2001; exports of tin fell to 4,706 kilograms (kg) in 2000 from 18,408 kg in 1999. Production of colombite-tantalite increased to 122,537 kg in 2001 from 46,000 kg in 1997; the value of colombite-tantalite produced amounted to about $2.49 million in 2001 (International Trade Centre, 2001; Mathias Sebahene, Burundi Ministry of Energy and Mines, written commun., 2002).

Burundi Mining Corporation (a joint venture between the Government and local private companies) held the mining titles to most of the largest gold deposits in Burundi. The deposits in the northeastern part of the country are believed to be exploited by artisanal miners. In 2001, Burundi's production of gold amounted to 415 kg (table 1). In recent years, the civil war has compelled the few companies involved in gold exploration to declare force majeure (Resource Information Unit, 2001, p. 61; Mathias Sebahene, Burundi Ministry of Energy and Mines, written commun., 2002).

Civil strife also has prevented the exploitation of Burundi's nickel resources. In 2001, Argosy Minerals Inc. sought a joint-venture partner to develop the Musongati nickel deposit but did not lift the force majeure it declared in April 2000 owing to continuing instability.

International Cement Review (2001a) estimated that Burundi's cement consumption amounted to 30,000 metric tons per year (t/yr) from 1999 to 2001. All the country's cement demand was met through imports; cement was sourced from Tanzania, Uganda, and Zambia. The 25,000-t/yr clinker-grinding facility near Bujumbura was reportedly damaged following rioting in 1996.

The state-owned Office National de la Tourbe (ONATOUR) was responsible for the production and distribution of peat. Shortages of fuel oil and spare parts impaired ONATOUR's production in 1997 and 1998. In 1999, production increased to 20,000 metric tons (t) before falling in 2000 and 2001 (table 1); the domestic market could absorb only 12,000 t/yr.

Burundi has no identified resources of coal, natural gas, or petroleum. The country does not have production facilities for petroleum products; all petroleum demand was met through imports. In 2001, consumption of petroleum products amounted to 48,093 t, which was an increase from 39,888 t in 1997 (International Monetary Fund, 2002a, p. 16).

In 2001, power production rose to 107.8 gigawatthours (GWh) from 99.2 GWh in 2000; most power was generated from hydroelectric sources. In the same year, the country consumed 108.8 GWh, which was an increase from 100.8 GWh in 2000 and 92.2 GWh in 1997. Imports were sourced from Congo (Kinshasa). Industrial consumption of electricity fell to

[1]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

43.5 GWh in 2001 from 44.5 GWh in 1997 (International Monetary Fund, 2002a, p. 16). In July 2000, the Burundi National Assembly voted to open the electricity sector to competition and to end the monopoly of the state electric utility.

Burundi's transportation network comprised about 14,500 kilometers (km) of highways, of which slightly more than 1,000 km was paved. The major waterway was Lake Tanganyika, which had a port at Bujumbura.

Economic growth was expected to be 3.4% in 2002 and 5% in 2003 (International Monetary Fund, 2002e, p. 174). High rates of GDP growth may lead to increased demand for such local construction materials as gravel, limestone, and sand. The severe environmental problems of deforestation may lead to increased demand for peat for use as fuel and in the exploitation of domestic phosphate rock resources to raise agricultural productivity. The outlook for columbium (niobium), tantalum, tin, and tungsten depends heavily upon the resolution of political instability and the global market; Burundi's domestic market is limited by the severe poverty of the country.

Columbium (niobium) demand was driven primarily by the steel and aerospace industries. Global consumption of finished steel was predicted to fall by about 0.7% in 2002 and to rise by 2.3% per year from 2003 to 2006. The world market for gold was expected to show little change in the near future. Modest decreases in mine production by 2003 were likely to be offset by falling demand. Tin consumption was expected to decline by about 1% in 2002 and to increase by nearly 3.6% in 2003. Cemented carbides represent the largest end use of tungsten. Future consumption depends upon the strength of the aerospace, construction, mining, oil and gas drilling, semiconductor, and other manufacturing industries (SG Securities Ltd., 2001, p. 19, 22; Shedd, 2002, p. 81.5; MEPS (International) Ltd., 2002§).

The outlook for unexploited commodities in Burundi, such as nickel, REE, and vanadium, also depended upon world market conditions. Increased demand for nickel and modest increases in nickel production capacity in 2003 were expected to lead to rising nickel prices. Global demand for rare-earth oxides was expected to increase to 100,000 t in 2005 from 74,000 t in 1999. Vanadium is expected to be in oversupply at least through 2003 or 2004; demand is unlikely to exceed 73,000 t/yr vanadium pentoxide equivalent, and production capacity from lower cost secondary sources totals more than 81,000 t/yr (Mining Journal, 2001b; SG Securities Ltd., 2001, p. 17-18; Chegwidden and Kingsworth, 2002).

COMOROS

The Federal Islamic Republic of the Comoros is located on three main islands in the Mozambique Channel about two-thirds of the way between northern Madagascar and northern Mozambique. In 2001, the GDP of Comoros amounted to about $930 million at purchasing power parity; GDP per capita at purchasing power parity was about $1,300 (United Nations, 2002, p. 2; International Monetary Fund, 2002a§, b§).

In recent years, political instability had a negative effect on the economy; in 2001, the GDP rose by 1.9% after falling by 1.1% in 2000 and rising by 1.9% in 1999 and 1.2% in 1998. The recession was particularly severe in the manufacturing and construction and public works sectors. In 2000, construction and public works accounted for about 6% of the GDP; manufacturing, 4%; and electricity, gas, and water, 2% (International Monetary Fund, 2001, p. 23; 2002e, p. 174).

In 2001, the mineral industry of Comoros continued to be limited to the production of common construction materials, such as clay, sand and gravel, and crushed stone, for local consumption. Cement was imported from Kenya and South Africa. The International Monetary Fund (2001, p. 53) estimated that cement imports rose to 41,542 t in 2000 from 25,094 t in 1999 and 24,504 t in 1998. Imports of iron and steel products fell to 2,633 t in 2000 from 3,300 t in 1999 and 3,223 t in 1998.

The production of electricity increased to 35 GWh in 2000 from 34.9 GWh in 1999 and 29.0 GWh in 1998. Comoros had an installed capacity of 12.7 megawatts (MW) in 2000. Officially reported consumption of electricity fell to 18 GWh in 2000 from 22 GWh in 1999. Problems with power losses and fraud have been increasing in recent years. Imports of petroleum products increased to 17,893 t in 2000 from 17,144 t in 1999 and 16,663 t in 1998 (International Monetary Fund, 2001, p. 32, 53). Geothermal energy resources are known to exist within the territory.

The outlook on minerals output was not expected to change significantly because Comoros has very limited natural resources. Domestic consumption of resources is likely to be constrained by severe poverty and slow economic growth. The International Monetary Fund (2002e, p. 174) predicted that the GDP would increase by 3.5% in 2002 and 3% in 2003. A constitutional referendum aimed at ending the crisis over the secession of the island of Anjouan was scheduled for late 2001. Import dependence and deforestation may lead to exploitation of the country's geothermal resources.

MALAWI

In recent years, Malawi, which is a small country in southern Africa, has produced cement, coal, crushed stone for aggregates, dolomite, lime, and limestone for domestic consumption (table 1). The country has been known to produce and export various gemstones, such as agate, amethyst, aquamarine, garnet, ruby, and sapphire. Artisanal miners produced clay, salt, and sand. Malawi has deposits of bauxite, granite, graphite, kaolin, kyanite, monazite, phosphate rock, pyrite, silica sand, titanium, tourmaline, uranium, and vermiculite. More-extensive information on the mineral deposits in Malawi can be found in the 2000 Minerals Yearbook.

In 2001, Malawi's GDP amounted to about $8.8 billion at purchasing power parity, and the per capita income at purchasing power parity was nearly $800. The GDP fell by 1.5% in 2001 after rising by 1.7% in 2000, 4% in 1999, and 3.3% in 1998. In 2000, manufacturing accounted for 11% of the GDP; construction, 2%; electricity and water, 1%; and mining and quarrying, 1%. From 1995 to 2000, the output of the mining and quarrying sector increased by 302% (International Monetary Fund, 2002b, p. 58; 2002e, p. 174; 2002a§, b§; United Nations, 2002, p. 4).

Digitized by Google

In 2001, Malawi's official mineral exports amounted to nearly $500,000, of which 41% was attributable to gemstones and industrial corundum. Gemstone exports were understated because of smuggling. Mineral imports, which included cement, coal, kaolin, and lime, amounted to about $6 million (Malawi Director of Mines, 2002, p. 4-7). In 2000, the value of imported petroleum products rose to $104.9 million from $66.1 million in 1999.

Paladin Resources Ltd. (2002, p. 10) planned to start a feasibility study on the Kayerekera uranium deposit in the first quarter of 2002. Depending on the results of the study, construction of the mine could start in late 2003. Paladin estimated that the project would produce 1,000 t/yr of uranium oxide (U_3O_8) and export revenue of $30 million to $34 million per year.

Allied Procurement Agency had a license for titanium sands at Chipoka in Salima; the company planned to start a mineral processing pilot plant in the near future. Crown Minerals held a license for titanium sands at Tengani in the Nsanje district (Malawi Director of Mines, 2002, p. 13-14).

In October 2000, BHP Billiton Plc discussed the possible exploitation of the Mulanje Mountain bauxite resources. The company also planned to review other bauxite deposits in the country with the goal of increasing national reserves to 50 million metric tons. Lisungwe Mineral Resources Ltd. (a subsidiary of Agricola Resources Ltd.) explored for chrome, gold, nickel, and PGM in the Kirk Range area. Albidon Ltd. of Australia explored for PGM at Bimbili River and Linthipe. Placer Dome Inc. funded copper and nickel exploration work on Ngala Hill (Malunga, 2001; Malawi Director of Mines, 2002, p. 13).

Portland Cement Company operated a clinker plant at Changalume and a clinker grinding plant at Blantyre. After falling in 2000 because of equipment rehabilitation, national cement production increased by 16% in 2001 (table 1). Shayona Cement Corporation opened a new plant at Livwezi in Kasungu, which contributed to the rise in output. The value of cement production amounted to $14.64 million in 2001. Small amounts of cement were imported from Tanzania, Zambia, and Zimbabwe. Basic infrastructure projects and private housing construction were major sources of cement demand (International Cement Review, 2001b; Malunga, 2001; Malawi Director of Mines, 2002, p. 1, 17).

Malawi's imports of fertilizers fell to 17,600 t in 2001 from 57,200 t in 2000 and 150,200 t in 1998. The country's consumption of fertilizers was estimated to be 150,000 t/yr. In September 2000, Optichem (2000) Ltd. resumed the production of fertilizers at a dormant plant in Blantyre. This company was a 5-year joint venture between Mauritius Chemical and Fertilizer Industry Ltd. (MCFI) and Malawi Development Corporation (MDC). At the end of 2005, MCFI would have the option of acquiring the factory, which had a capacity of 40,000 t/yr of compound fertilizer (Malawi Development Corporation, 2001§).

Optichem was expected to mine local raw materials, such as the Tundulu phosphate rock deposits. MDC estimated that the feasibility study and other work necessary to implement the Tundulu project would last until 2005; mining and processing of the ore was expected to cost about $6.2 million. The Centre for Development of Enterprise (CDE), which was an institution supported by the European Union and the African, Pacific, and Carribean Group of States, promised to assist in financing the Tundulu phosphate rock project. Other minerals projects that the CDE agreed to finance included the Kangankunde rare earths, the Mabulabo talc, the Salima titanium sands, and the Mwanza vermiculite (Malunga, 2001; Malawi Development Corporation, 2001§).

MDC also sought financing for the Bwanje Valley limestone project to produce high-grade hydrated lime and pulverized limestone. MDC estimated the cost of the project to be $12 million; implementation was expected in 2003 and 2004. Other companies involved in lime limestone and granite exploration and production included Granites Ltd., Multi Royal Mining Company, Raval Building Contractors, and Zalewa Lime Company (Malawi Director of Mines, 2002, p. 13-14; Malawi Development Corporation, 2001§).

In 2001, Agricola reopened the Chimwadzulu ruby and sapphire mine and reported the recovery of "outstanding" rubies. The company planned to cut and polish rough ruby and sapphire from the mine. Resources of ruby at Chimwadzulu were estimated to be 247 kg, of which 59 kg were indicated and 188 kg were inferred. Total corundum resources were estimated to be 7,960 kg, the majority of which was sapphire that required heat treatment. Preliminary testing indicated that only 5% of the rough sapphire may be economic (David Williamson Associates Ltd., 2001; Mining Journal, 2001a).

Lisungwe received a new prospecting license for a 100-square-kilometer area about 15 km east of Chimwadzulu; this area contains deep-pink ruby. Mofa Enterprise was prospecting for tourmaline in Mangochi. In 2000, amethyst and aquamarine accounted for most of Malawi's gemstone production. A newly discovered deposit of yellow and yellow-green tourmaline produced about 1,000 carats per month in 2001 (Boehm, 2001; Malunga, 2001; Mining Journal, 2001a; Malawi Director of Mines, 2002, p. 13).

Malawi has no identified resources of natural gas or petroleum. The country does not have production facilities for petroleum products; all petroleum demand was met through imports. Coal Products Ltd. operated the Mchenga coal mine, which was privatized in 1999. After falling for the fourth consecutive year in 2000, Malawi's production of coal increased slightly in 2001. The value of domestic coal production amounted to $1.39 million in 2001. Coal Products Ltd. also explored for coal near Chombe. Malawi Minerals Ltd. held exploration licenses for coal and coalbed methane gas (Malawi Director of Mines, 2002, p. 1, 12-14).

In October 2000, the Electricity Supply Commission of Malawi (ESCOM) increased its hydroelectric capacity to 285 MW from 220.7 MW with the inauguration of the Kapichira plant; thermal capacity was 21.4 MW. Lack of investment in the distribution network caused disruptions that reduced power availability to about 90%. From 1995 to 1999, ESCOM's production of electricity increased to 1,021 GWh from 857.5 GWh; the company accounted for 90% of total electricity generated in Malawi (Malunga, 2001; National Statistical Office of Malawi, 2001, p. 49-50).

Digitized by Google

Malawi had about 28,400 km of roads, of which about 5,300 km was paved; the rail network covered nearly 800 km. Railways were managed by CFM/SDCN, which was the Mozambican railway company. Waterways included Lake Malawi and the Shire River.

Because most of Malawi's minerals industry was for local consumption in 2001, the short-term outlook for most currently produced minerals depends on the state of the domestic economy. The International Monetary Fund (2002e, p. 174) predicted that Malawi's economy would grow by 1.8% in 2002 and by 4.5% in 2003. Deforestation may lead to increased coal production for local energy use.

The outlook for the gemstone industry depends mostly upon world market conditions. In general, gemstone sales were expected to remain stable or show a slight increase in 2002, although demand for aquamarine and yellow tourmaline was expected to be strong. Agricola's production of ruby was expected to be 28 kg in 2001 and 33 kg in 2002 (David Williamson Associates Ltd., 2001; Jewellery News Asia, 2001).

The outlook for many of Malawi's unexploited mineral commodities is also tied to strong global demand because the country's severe poverty limits its domestic market for bauxite, columbium (niobium), graphite, REE, titanium, and uranium. Demand for titanium dioxide (TiO_2) pigment is expected to increase by about 3% to 4% per year from 2002 to 2006. About 95% of all titanium minerals is consumed to produce TiO_2 pigment. Prices of U_3O_8 are expected to remain in the $9-to-$12-per-pound range for several years and are unlikely exceed $18 per pound by 2010. The development of new uranium mines is possible in the short term and probable in the long term; consumption was about 53,000 t/yr, and stockpiles will eventually be depleted if production continues to remain below 35,000 t/yr (Gambogi, 2001; Metal Bulletin, 2001; Pool, 2001). Information on the global market outlook on columbium (niobium) and REE can be found in the section on Burundi.

MAURITIUS

The Republic of Mauritius is about 1,000 km east of Madagascar. In 2001, the GDP of Mauritius amounted to about $14.4 billion at purchasing power parity, and the per capita income at purchasing power parity was about $12,000. The GDP increased by 7.2% in 2001 after rising by 2.6% in 2000, 5.3% in 1999, and 6% in 1998. Manufacturing accounted for about 21% of the GDP; construction, 5%; and electricity, gas, and water, 2%. The mining and quarrying industry was a negligible factor in the economy (International Monetary Fund, 2002c, p. 38; 2002e, p. 174; 2002a§, b§; United Nations, 2002, p. 4).

Historically, mineral output consisted of local production and use of basalt construction stone, coral sand, lime from coral, and solar-evaporated sea salt. The production of salt and sand declined by 19% and 11%, respectively, in 2000. In April 2001, the Government announced plans to ban sand extraction from the Port Louis lagoon to protect the marine environment and tourist industry; the ban would become effective in October 2002. Other sources of sand for the construction industry included rock sand and basalt sand (Ackbarally, 2001§; N. Rummun, Mauritius Ministry of Agriculture, Food Technology, and Natural Resources, written commun., 2001).

International Cement Review (2001c, p. 206) estimated that Mauritius consumed 670,000 t of cement in 2001; this was an increase from 620,000 t in 1999 and 650,000 t in 2000. All the country's cement was imported, mainly from Asian or Middle Eastern countries.

Steel reinforcing bars (rebar) and welded mesh were made from imported ingot at three rolling mills. Imports of billet were sourced mainly from South Africa, and rebar and welded mesh were exported to Comoros, Madagascar, and Reunion. In late 2000, Consolidated Steel Ltd., which was a rebar producer in Port Louis, postponed its plans to install its own raw steelmaking facilities until the Government completed the phaseout of tariffs on its products (Metal Bulletin, 2000).

Mauritius Chemical and Fertilizer Industry Ltd. was the country's only producer of fertilizers. In 2000, fertilizer production increased to 87,400 t from 85,300 t in 1999 and 83,200 t in 1998 (table 1). Imports of potassic fertilizers rose to 29,380 t in 2000 from 27,208 t in 1999 and 28,801 t in 1996 (British Geological Survey, 2002, p. 219).

In 2000, Mauritius imported about $33.74 million of diamond. Rough gems accounted for $16.42 million; cut gems, $10.09 million; and industrial, $7.23 million. In the same year, Mauritius exported about $35.41 million of diamond. Rough gems accounted for $227,000; cut gems, $34.77 million; and industrial, $415,000 (British Geological Survey, 2002, p. 79, 83). Companies engaged in diamond cutting in Mauritius included Adamas Ltd., Mauridien Ltd., and MS Contracting Ltd.

Mauritius has no identified resources of fossil fuels. Imports of coal increased to 222,423 t in 2000 from 128,879 t in 1999 and 38,482 t in 1996. Gamma Civic Ltd. operated an asphalt plant; the demand for all other petroleum products was met through imports. In fiscal year 2000-2001, the value of imported petroleum products amounted to nearly $220 million (British Geological Survey, 2002, p. 58; International Monetary Fund, 2002c, p. 74).

Production of electricity totaled 1,657.1 GWh in 2001, which was an increase from 1,564.9 GWh in 2000 and 1,251.8 GWh in 1997. The country's effective plant capacity increased to 513.9 MW in 2001 from 370 MW in 1997. During the same period, production by the Central Electricity Board fell to 946.9 GWh from 1,103.5 GWh. Fossil fuels and hydroelectric power sources provided 95.7% and 4.3%, respectively, of national production in 2001. From 1997 to 2001, energy purchased from sugar and other factories increased to 710.2 GWh from 148.3 GWh (International Monetary Fund, 2002c, p. 50).

The economy of Mauritius is likely to continue to grow rapidly in the near future. The International Monetary Fund (2002e, p. 174) predicted that the GDP would increase by 5.3% in 2002 and by 4.9% in 2003. In the short run, the growth in the minerals sector is likely to be restricted to construction materials. Offshore oil exploration has been inconclusive, and polymetallic nodules on the ocean floor are unlikely to be developed in the foreseeable future.

Digitized by Google

REUNION

Reunion, which is an overseas department of France, is about 650 km east of Madagascar. Production of mineral commodities represented only a small part of the economy of Reunion, although little quantitative information was available.

Reunion's imports of potassic fertilizers fell to 900 t in 2000 from 1,800 t in 1996. The country imported an estimated 2,900 t/yr of salt from 1996 to 1999 (British Geological Survey, 2002, p. 219, 232). Hydraulic cement was made by grinding imported clinker. The Ciments de Bourbon S.A. cement grinding plant at Le Port (owned by Holcim Ltd.) had a capacity of 400,000 t/yr. International Cement Review (2001d, p. 248) estimated that Reunion's cement production was 400,000 t/yr in 2000 and 2001, which was an increase compared with 380,000 t/yr in 1998 and 1999. Imports, which were mainly clinker, were estimated to be 540,000 t in 2001 and 520,000 t in 2000. Additionally, production of volcanic rock and seacoast coral continued to meet local construction needs. Little change in future mineral activity is anticipated.

RWANDA

In recent years, Rwanda's mineral industry has produced gold ores and concentrates of columbium (niobium)-tantalum, tin, and tungsten, most of which has been designated for export. This small country in Central Africa has also produced cement and small quantities of natural gas (table 1). The Rwandan mineral industry consisted mostly of a number of small cooperatives and individual artisanal miners that produced ores and concentrates from scattered locations generally in a zone about 30 km wide that extends east-west through Kigali. The country is also known to have deposits of beryllium, kaolin, and peat.

In 2001, Rwanda's GDP amounted to about $7.4 billion at purchasing power parity. The GDP grew by 6.7% in 2001 after increasing by 6% in 2000, 7.6% in 1999, and 8.9% in 1998. Per capita income at purchasing power parity was $900. In 2000, manufacturing accounted for 9% of the GDP; construction, 7%; and mining and quarrying, less than 1%. From 1995 to 2000, output in the mining and quarrying sector grew by 355% in real terms. During the same period, the post-civil-war repair of Rwanda's infrastructure caused output in the construction sector to grow by 118% (Banque Nationale du Rwanda, 2001, p. 32; International Monetary Fund, 2002e, p. 174; 2002a§, b§; United Nations, 2002, p. 5).

COPIMAR, which was a group of many small miners' cooperatives, and Régie d'Exploitation et de Développement des Mines (REDEMI) produced ores of columbium (niobium), tantalum, tin, and tungsten. Colombite-tantalite was produced from numerous mines near Gikongoro, Kamonyi (in the Province of Gitarama), Kayenzi, Kibongo, Shyorongi, and Taba. Concentrating facilities were located at Gatumba.

In 2001, the value of colombite-tantalite produced in Rwanda amounted to $36.15 million. In 2000, rising prices for colombite-tantalite caused production to increase to 561 t from 147 t in 1999; the number of mining licenses for colombite-tantalite increased to 15 from 3 in the same period. Falling prices caused output to fall to 241 t in 2001 (B.M. Marcel, Rwanda Ministry of Energy, Water, and Natural Resources, written commun., 2001, 2002).

In 2001, exports of colombite-tantalite amounted to $44 million. In 2000, exports of colombite-tantalite increased to nearly 603 t at a value of $11.3 million from 330 t at a value of $4.6 million in 1999 and 54 t at a value of $600,000 in 1995. Exports of colombite-tantalite and other minerals accounted for 18% of Rwanda's total exports in 2000 (Banque Nationale du Rwanda, 2001, p. 105; Kamuze, 2002).

Cassiterite was mined at Gatumba and Shyorongi. REDEMI operated a cassiterite processing facility at Rutongo. In 2001, falling prices for tin caused output to fall to 171 t from 276 t in 2000. From 1995 to 2000, exports of cassiterite increased to 365 t from 247 t; the value remained unchanged at $900,000 (Banque Nationale du Rwanda, 2001, p. 105; B.M. Marcel, Rwanda Ministry of Energy, Water, and Natural Resources, written commun., 2001, 2002).

Wolframite was mined at Shyorongi. In 2001, the value of tungsten concentrates produced in Rwanda amounted to $452,000. In 2000, rising prices for tungsten caused output to increase to 108 t from 41 t in 1999; production also increased substantially in 2001. From 1995 to 2000, exports of tungsten concentrates increased to 144 t at a value of $300,000 from 19 t at a value of $100,000 (Banque Nationale du Rwanda, 2001, p. 105; Bahunde M. Marcel, Rwanda Ministry of Energy, Water, and Natural Resources, written commun., 2001, 2002).

In 2001, the United Nations Security Council issued a report that accused Rwandan Government officials, military officers, and businessmen of illegally exploiting columbium (niobium), diamond, gold, and tantalum from Congo (Kinshasa) to enrich themselves and finance their country's military presence in Congo (Kinshasa). The Rwandan Government denied the accusations. Others accused of using their military presence to exploit Congolese mineral resources included rebel forces that operated in Congo (Kinshasa) and the Governments of Namibia, Uganda, and Zimbabwe (United Nations Security Council, 2001a, p. 16-21, 25, 29-37; 2001b, p. 6-11, 16-23).

Cimenterie du Rwanda (Cimerwa) was Rwanda's only producer of cement; the company's production increased to 83,024 t in 2001 from 42,452 t in 1996. In 2001, Cimerwa announced plans to increase production to 115,000 t/yr and to start exporting cement; local demand was expected to be only 90,000 t/yr (International Monetary Fund, 2002d, p. 10; Rubingisa, 2002§).

Rwanda has no identified resources of coal or petroleum. The country did not have production facilities for petroleum products; all petroleum demand was met through imports. In 2000, imports of energy products increased to $62 million from $42.6 million in 1999 and $21.8 million in 1995. Energy imports accounted for 20% of Rwanda's total imports (Banque Nationale du Rwanda, 2001, p. 103).

Natural gas production fell by nearly 40% in 2001 after increasing by 1.5% in 2000 (table 1); inadequate infrastructure has inhibited plans to increase industrial consumption of natural gas. Gisenyi Electric and Gas Company planned to increase natural gas production from Lake Kivu starting in 2001. The company's project would increase power-generating capacity by

Digitized by Google

10 MW and would decrease Rwanda's reliance on firewood and imported electricity (Africa Energy Intelligence, 2001; Banque Nationale du Rwanda, 2001, p. 31).

In 2001, Rwanda's production of electricity amounted to 89.27 GWh, which was a decrease from 110.84 GWh in 2000 and an increase from 72.16 GWh in 1996. From 1996 to 2001, imports increased to 121.5 GWh from 82.58 GWh. Hydroelectric sources provided most of Rwanda's electricity (International Monetary Fund, 2002d, p. 11).

Rwanda's transportation network comprised about 12,000 km of roads, of which 1,000 km was paved. Lake Kivu was navigable by shallow-draft barges and native craft. Transportation costs are among the highest in Africa.

The International Monetary Fund (2002e, p. 174) predicted that Rwanda's GDP would grow by 6.5% in 2002 and by 6.2% in 2003; the improving economic situation may lead to increased consumption of construction materials. The severe environmental problems caused by deforestation may lead to exploitation of domestic peat resources. The outlook for Rwanda's mineral industry depends on the resolution of political instability and favorable world market conditions for columbium (niobium), gold, tantalum, tin, and tungsten. Information on the global market outlook on columbium (niobium), gold, tin, and tungsten industries can be found in the section on Burundi.

SEYCHELLES

The Republic of Seychelles is a group of 40 granitic and 50 or more coralline islands northeast of Madagascar in the Indian Ocean. In 2001, the GDP of Seychelles amounted to about $900 million at purchasing power parity. The GDP contracted by 8.1% in 2001, 5.4% in 2000, and 2.8% in 1999. Mining, manufacturing, and handicrafts accounted for about 14% of the GDP; building and construction, 10%; and electricity, about 3% (Central Bank of Seychelles, 2001, p. 32; International Monetary Fund, 2002e, p. 174; 2002a§, b§).

Mineral production in Seychelles consisted mostly of production of such construction materials as clay, coral, sand, and stone. Gondwana Granite exploited local granite resources; the production of granite in Seychelles amounted to 6,044 t in 2001 and 54,788 t in 2000. Civil Construction Company Ltd. and United Concrete Products of Seychelles produced crushed rock, gravel, and sand. In 2001, the reported production of gravel and crushed rock increased by 19%, and the reported production of sand fell by nearly 33%. Cement requirements were met from imports, which were estimated to be 40,000 t/yr from 1998 to 2001 (International Cement Review, 2001e, p. 259; Mamy Razanajatovo, Seychelles Ministry of Industries and International Business, written commun., 2002).

The production of electricity increased to 189 GWh in 2000 from 172 GWh in 1999 and 129 GWh in 1995. Imports of mineral fuels accounted for nearly 22% of total imports. The value of mineral fuel imports increased by 85% in 2000 owing to higher oil prices (Central Bank of Seychelles, 2001, p. 27, 33).

The International Monetary Fund (2002e, p. 174) predicted that the GDP of Seychelles would decline by 2.4% in 2002 and by 0.6% in 2003. The short-term outlook for mineral production is for little change. Seychelles has modest natural resources, and any newly discovered resources of petroleum and natural gas could not be exploited immediately.

References Cited

Africa Energy Intelligence, 2001, Rwanda—Power from Lake Kivu: Africa Energy Intelligence, no. 294, March 7, p. 6.

Banque Nationale du Rwanda, 2001, Rapport sur l'evolution economique et financiere du Rwanda 2000: Kigali, Rwanda, Banque Nationale du Rwanda, 168 p.

Boehm, Edward, 2001, Canary tourmaline from Malawi: Gems & Gemology, v. 6, no. 2, summer, p. 151-152.

British Geological Survey, 2002, World mineral statistics 1996-2000: Keyworth, United Kingdom, British Geological Survey, 304 p.

Central Bank of Seychelles, 2001, Statistical appendix, *in* Quarterly review: Victoria, Seychelles, Central Bank of Seychelles, first quarter, 35 p.

Chegwidden, Judith, and Kingsnorth, D.J., 2002, Rare earths supply and demand—A European market focus: Industrial Minerals, no. 415, April, p. 52-61.

David Williamson Associates Ltd., 2001, Agricola Resources Plc—New ruby mining company offering mine to market exposure: London, United Kingdom, David Williamson Associates Ltd., 12 p.

Gambogi, Joseph, 2001, Titanium: Engineering & Mining Journal, v. 202, no. 4, April, p. 50-52.

International Cement Review, 2001a, Burundi, *in* Global cement report: Dorking, United Kingdom, Tradeship Publications, Ltd., p. 90.

International Cement Review, 2001b, Malawi, *in* Global cement report: Dorking, United Kingdom, Tradeship Publications, Ltd., p. 199.

International Cement Review, 2001c, Mauritius, *in* Global cement report: Dorking, United Kingdom, Tradeship Publications, Ltd., p. 206.

International Cement Review, 2001d, Reunion, *in* Global cement report: Dorking, United Kingdom, Tradeship Publications, Ltd., p. 248.

International Cement Review, 2001e, Seychelles, *in* Global cement report: Dorking, United Kingdom, Tradeship Publications, Ltd., p. 259.

International Monetary Fund, 2001, Comoros—Recent economic developments: Washington, DC, International Monetary Fund, August 8, 57 p.

International Monetary Fund, 2002a, Burundi—Statistical annex: Washington, DC, International Monetary Fund, November 4, 59 p.

International Monetary Fund, 2002b, Malawi—Selected issues and statistical appendix: Washington, DC, International Monetary Fund, August 16, 94 p.

International Monetary Fund, 2002c, Mauritius—Selected issues and statistical appendix: Washington, DC, International Monetary Fund, July 15, 98 p.

International Monetary Fund, 2002d, Rwanda—Statistical appendix: Washington, DC, International Monetary Fund, August 16, 35 p.

International Monetary Fund, 2002e, World economic outlook—Trade and finance: Washington, DC, International Monetary Fund, September, 235 p.

International Trade Centre, 2001, Case studies—COMEBU: Geneva, Switzerland, International Trade Centre, 5 p.

Jewellery News Asia, 2001, Gemstone sales may be stable or up slightly: Jewellery News Asia, no. 208, December, p. 72.

Kamuze, Gertrude, 2002, Coltan up, coffee down as Rwanda grows 6pc: East African, February 18-24, p. 5.

Malawi Director of Mines, 2002, Malawi annual mining economic report 2001: Lilongwe, Malawi, Malawi Department of Mines, 18 p.

Malunga, G.W.P., 2001, Malawi, *in* Mining annual review 2001: London, United Kingdom, Mining Journal Ltd. CD-ROM.

Metal Bulletin, 2000, Tariff cuts threaten Mauritian rolling mill: Metal Bulletin, no. 8530, November 30, p. 20.

Metal Bulletin, 2001, New uranium mines still needed, says report: Metal Bulletin, no. 8592, September 13, p. 7.

Mining Journal, 2001a, Agricola's additional license: Mining Journal, v. 336, no. 8635, May 25, p. 402.

Mining Journal, 2001b, Vanadium mining doomed?: Mining Journal, v. 337, no. 8664, December 14, p. 456.

National Statistical Office of Malawi, 2001, Statistical yearbook 2001: Zomba, Malawi, National Statistical Office of Malawi, 86 p.

Paladin Resources Ltd., 2002, Annual report—2001: Sydney, Australia, Paladin Resources Ltd., 33 p.

Pool, T.C., 2001, Uranium—Prices down, production up: Engineering & Mining Journal, v. 202, no. 4, April, p. 50-52.

Digitized by Google

Resource Information Unit, 2001, Burundi, *in* Register of African mining 2001/02: Subiaco, Australia, Resource Information Unit, p. 61.
SG Securities Ltd., 2001, Quarterly metals review—A mountain to climb: London, United Kingdom, SG Securities Ltd., October, 28 p.
Shedd, K.B., 2002, Tungsten, *in* Metals and minerals: U.S. Geological Survey Minerals Yearbook 2000, v. I, p. 81.1-81.18.
Songore, Tharcisse, 2001, Burundi *in* Mining annual review 2001: London, United Kingdom, Mining Journal Ltd. CD-ROM.
United Nations, 2002, Population estimates, mid-year: Monthly Bulletin of Statistics, v. 56, no. 7, July, p. 1-6.
United Nations Security Council, 2001a, Addendum to the report of the panel of experts on the illegal exploitation of natural resources and other forms of wealth of the Democratic Republic of the Congo: New York, New York, United Nations Security Council Report S/2001/363, 38 p.
United Nations Security Council, 2001b, Report of the panel of experts on the illegal exploitation of natural resources and other forms of wealth of the Democratic Republic of the Congo: New York, New York, United Nations Security Council Report S/2001/357, 56 p.

Internet References Cited

Ackbarally, Nasseem, 2001 (April 11), Government bans sand extraction from lagoon, accessed April 17, 2001, at URL http://allafrica.com/stories/printable/200104110401.html.
International Monetary Fund, 2002a (April), Selected world aggregates, World Economic Outlook Database, accessed June 10, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/01/data.
International Monetary Fund, 2002b (April), Shares of aggregate GDP based on purchasing power parity (PPP) valuation of country GDP—Developing countries, World Economic Outlook Database, accessed June 10, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/01/data.
Malawi Development Corporation, 2001, Project pipeline, accessed March 8, 2002, via URL http://www.mdc.co.mw.
MEPS (International) Ltd., 2002, Abstract from global iron and steel production to 2006, accessed April 23, 2002, via URL http://www.meps.co.uk.
Rubingisa, Jean-Claude, 2002, One year economically rich in events, accessed March 8, 2002, at URL http://www.orinfor.gov.rw/docs/Economie11.htm.

Digitized by Google

TABLE 1
BURUNDI, MALAWI, MAURITIUS, RWANDA, AND SEYCHELLES: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Country and commodity		1997	1998	1999	2000	2001
BURUNDI						
Clays, kaolin		3,539 r/	3,500 r/	1,597 r/	1,500 r/	--
Columbite-tantalum, mine output, ore (32% Ta_2O_5)						
Gross weight	kilograms	46,000	30,840 r/	42,149 r/	31,175 r/	122,537
Ta_2O_5 content	do.	13,800 r/	9,200 r/	12,600 r/	10,013 r/	39,359
Gold, mine output, Au content	do.	-- r/	-- r/	-- r/	-- r/	415
Lime e/		50	50	50	-- r/ 2/	--
Peat 3/		9,000 r/	11,000 r/	20,000 r/	4,088 r/	5,000
Tin, mine output, Sn content		15 r/	9 r/	18 r/	7 r/	4
Tungsten, mine output, W content		16 e/	-- r/	-- r/	-- r/	-- e/
MALAWI 4/						
Cement, hydraulic		175,800	134,000	186,500	155,920 r/	180,785
Coal		63,210	54,200	43,800	34,250 r/	34,410
Dolomite e/		1,100	1,100 r/	1,200 r/	-- r/ 2/	-- 2/
Gemstones	kilograms	351	934	649	16,390 r/	16,500 e/
Kaolin		NA	NA	NA	719	825
Lime		1,940	2,600	2,900	21,886 r/	6,177
Sodium silicate		NA	750	803	1,538	--
Stone:						
Crushed for aggregate		251,655 r/	283,055 r/	111,095 r/	80,780 r/	594,979
Dimension, crude and partly worked		NA	NA	NA	78	78
Limestone, for cement		258,000	171,900	171,900	144,000 r/ e/	167,000 e/
Vermiculite		NA	NA	NA	--	1
MAURITIUS 5/						
Fertilizers		78,600 e/	83,200	85,300	87,400	92,600 e/
Iron and steel, semimanufactures		41,800 e/	44,300	45,000	45,000	48,000 e/
Salt, sea		6,000	6,200	7,435	6,000	6,000 e/
Sand, coral		424,000 e/	437,000 e/	450,000	400,000	412,000 e/
RWANDA						
Cement		60,505 r/	58,929 r/	66,291 r/	70,716 r/	83,024
Columbite-tantalite, ore and concentrate:						
Gross weight	kilograms	256,000 r/	224,000	147,000 r/	561,000 r/	241,000
Nb content	do.	80,500 r/	70,500 r/	46,200 r/	176,000 r/	75,800
Ta content	do.	54,100 r/	47,300 r/	31,000 r/	118,000 r/	50,900
Gold, mine output, Au content	do.	10	17	10	10	10 e/
Natural gas, gross	million cubic meters	357 r/	855 r/	1,353 r/	1,373 r/	828
Tin, mine output, Sn content		107 r/	187 r/	248 r/	276 r/	171
Tungsten, mine output, W content		57 r/	109 r/	41 r/	108 r/	148
SEYCHELLES						
Dimension stone, granite		NA	NA	NA	54,788	6,044
Gravel and crushed rock		NA	NA	NA	81,400	96,819
Sand		NA	NA	NA	12,053	8,128

e/ Estimated; estimated data are rounded to no more than three significant digits. r/ Revised. NA Not available. -- Zero.

1/ Includes data available through February 12, 2003.

2/ Reported figure.

3/ Reported on the basis of fiscal year starting on May 1.

4/ In addition to commodities listed, modest quantities of salt and unlisted varieties of crude construction materials (clays, sand and gravel, and other stone) may also be produced, but information is inadequate to make reliable estimates of output levels.

5/ In addition to the commodities listed, asphalt, basalt and lime are also known to be produced, but information is inadequate to make reliable estimates of output levels.

Digitized by Google

THE MINERAL INDUSTRY OF

CHAD

By Philip M. Mobbs

The mineral industry was poised to become a significant segment of Chad's economy as the Doba Basin project got underway. Subject to crude oil price fluctuations, the country could receive up to $2 billion of revenue associated with petroleum production during the 30-year life of the Doba Basin Project (Africa Energy & Mining, 2000; World Bank, 2000). In 2001, the change in the nation's gross domestic product (GDP) was estimated to be 8.9% (International Monetary Fund, 2002, p. 164). The GDP had been estimated to be $1.4 billion in 2000 (World Bank, 2001§[1]). By 2004, when exportation of crude oil was scheduled to begin, Government income was expected to increase significantly with the revenue from petroleum development to be funneled into investment in the building, education, health, and transportation sectors.

Mineral production in Chad included gold produced from Afko Corea Ltd.'s mine at Ganboké and placer deposits in the Mayo Dala Département (formerly the Mayo Kebbi Préfecture); gravel, sand, and silt from the Chari and the Logone Rivers; limestone from the Louga quarry; natron (soda ash) from Lake Chad south and east of Liwa; and crushed rock from the Mani quarry at Dandi. Clay was mined from numerous pits to manufacture brick. Salt was mined from various locations. The country's undeveloped mineral resources included bauxite near Guidara; columbium (niobium)-tantalum in the Tibesti region; diatomite at Faya Largeau and at Koro Toro; graphite at Gabil and near Waya Waya; kaolin near Kelo and near Abou Déïa; limestone near Baoaré and in the north; marble at Dolko, Teubara, and in the Ouaddaï region; soapstone near Léré; and tin and tungsten deposits in the Tibesti region. Additionally, occurrences of chromite, copper, diamond, iron, lead, nickel, titanium, uranium, and zinc were reported (Mining Journal, 2000; European Union, 1998§; Direction de Recherches Géologiques et Miniéres, written commun., [undated]).

In 2001, Afko began production at its $20 million gold mine at Ganboké, about 300 kilometers (km) south of N'Djamena. Conflicting reports place the mine's output in a range from 5 to 200 metric tons per day of ore (U.S. Embassy, N'Djamena, Chad, 2000; Africa Mining Intelligence, 2001).

The Esso Exploration and Production Chad, Inc. (EssoChad) (40% equity interest), Petroliam Nasional Bhd. (35%), and Chevron Overseas Petroleum Inc. (25%) consortium continued their Chad/Cameroon export pipeline and Doba Basin oilfield development project. The Doba Basin accounted for most of Chad's recoverable crude oil resources, which were estimated to be 1 billion barrels (U.S. Energy Information Administration, February 2000§). In 2001, the consortium's first drilling rig was reassembled and commissioned. In December, the rig spudded a test well near Nya. At Komé, construction of the field's pumping and treatment facilities commenced. Brush and tree clearance began along the right-of0way for the 1,070-km Chad-Cameroon export pipeline (Esso Exploration and Production Chad, Inc., undated§). In December, the first segments of the pipeline were welded together and laid in a 2-meter-deep trench near Belabo, Cameroon.

Controversy continued to dog the Doba Basin development and export pipeline project. In 2001, the World Bank investigated allegations of the diversion by the Chadian Government of a portion of a $25 million bonus paid by the EssoChad consortium in May 2000, which was prior to the World Bank's approval of a loan to finance the Government's interest in the Doba Basin Development, to buy armaments instead of routing the funds from the oil project through the proposed oil revenue oversight committee (Africa Energy Intelligence, 2000, 2002a). The Government subsequently established the World Bank-approved College de Control et de Surveillance des Revenus Petrolliers to oversee the use of the oil project's funds.

Another petroleum development project in Chad included the redevelopment of the Sedigui oilfield; the laying of a 317-km pipeline from the field to a planned oil refinery at Farcha, near N'Djamena; the construction of the proposed 5,000-barrel-per-day-capacity refinery; and the construction of a 16-megawatt powerplant at Farcha. The project stalled in 2001, as the construction contractor (Concorp International Ltd. of Sudan) failed to complete the pipeline and the refinery facilities (Africa Energy Intelligence, 2001a, b, 2002b).

References Cited

Africa Energy Intelligence, 2000, Chad—How to use oil dividend: Africa Energy Intelligence, no. 287, November 22, p. 5.
Africa Energy Intelligence, 2001a, Chad—Has Concorp tossed in towel?: Africa Energy Intelligence, no. 311, November 28, p. 3.
Africa Energy Intelligence, 2001b, Chad—Vivendi counting on Sedigui: Africa Energy Intelligence, no. 301, June 20, p. 1.
Africa Energy Intelligence, 2002a, Chad—A flap at World Bank: Africa Energy Intelligence, no. 317, February 27, p. 4.
Africa Energy Intelligence, 2002b, Chad—Inquiry into IPP project: Africa Energy Intelligence, no. 315, January 30, p. 6.
Africa Energy & Mining, 2000, Chad/Cameroon—Fallout from oil projects: Africa Energy & Mining, no. 284, October 11, p. 4.
Africa Mining Intelligence, 2001, First gold mine inaugurated: Africa Mining Intelligence, no. 13, April 25, p. 3.
International Monetary Fund, 2002, World economic outlook—Recessions and recoveries: Washington, DC, International Monetary Fund, 225 p.
Mining Journal, 2000, Chad, *in* Mining annual review 2000: London, United Kingdom, Mining Journal Ltd. CD-ROM.
U.S. Embassy, N'Djamena, Chad, 2000, Gold mining in Chad: U.S. Department of State Telegram 001775, November 14, 2 p.

[1]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

World Bank, 2000, World Bank Group approves support for Chad-Cameroon petroleum development and pipeline project: Washington, DC, World Bank news release 2000/395/AFR, June 6, 3 p.

Internet References Cited

Esso Exploration and Production Chad, Inc., [undated], Supporting documents—Section 1—Project overview, accessed April 7, 2001, via URL http://www.essochad.com/eaff/essochad/documentation/english/sd_v1_toc.html.
European Union, 1998, Chad, Country Profile, accessed August 25, 1998, at URL http://www.mines98.com/country/td/index.htm.
U.S. Energy Information Administration, 2000 (February), Chad—Energy overview, Country Analysis Brief, accessed November 2, 2000, at URL http://www.eia.doe.gov/emeu/cabs/chad.html.
World Bank, 2001 (September 2), Chad at a glance, accessed May 15, 2002, via URL http://www.worldbank.org/data/countrydata/countrydata/html.

Major Sources of Information

Direction de Recherche des Mines et de la Géologie
Ministère des Mines, de l'Energie et du Petrole
B.P. 906
N'Djamena, Chad
Telephone: +(235) 51-2-66
Fax: +(235) 51-5-330

Direction de Petrole
Ministère des Mines, de l'Energie et du Petrole
B.P. 94
N'Djamena, Chad
Telephone: +(235) 52-38-50
Fax.: +(235) 52-25-65

Digitized by Google

THE MINERAL INDUSTRY OF

CONGO (BRAZZAVILLE)

By George J. Coakley

The Republic of Congo [Congo (Brazzaville)] is in equatorial central Africa between the Democratic Republic of the Congo [Congo (Kinshasa)] and Gabon and has an area of 342,000 square kilometers. The area supported a population of more than 3.1 million in 2001 with a gross domestic product (GDP) per capita of $1,100 based on 2000 purchasing power parity data (U.S. Central Intelligence Agency, 2000§[1]). The civil war, which began in 1997, ended with the signing of a formal cease-fire agreement between the Government and resistance forces in January 2000. The war had damaged the economy and the land-based infrastructure significantly and displaced 800,000 Congolese. During 2001, with the support of the World Bank and the International Monetary Fund, the country began the process of refugee resettlement, stabilizing the political climate and rebuilding the economy and physical infrastructure. The Government prepared a new draft constitution and announced plans to privatize most of the state-run industries, including petroleum and electric power. Legislation aimed at liberalizing investment rules for the mining sector was proposed for late 2001 or early 2002. The proposed legislation would limit the Government's regulatory function and reduce state participation to no more than 10% to 15% of equity shares. Progress in rebuilding the country during 2001, however, faced a major setback in early 2002. Following the Presidential election on March 10, 2002, renewed fighting between Government and opposition forces threw the country back into turmoil.

The economy continued to be based largely on crude oil. According to the U.S. Energy Information Administration (2002§) oil accounted for more than 50% of the nation's GDP, 60% to 80% of the Government budget, and about 90% of export earnings. Oil exports in 2001 were valued at $2.5 billion. With higher oil prices and a projected 30% increase in oil production, 2002 oil export revenues were expected to be considerably higher.

Government Policy and Legislation

The Government agency responsible for administering the minerals sector is the Ministère des Hydrocarbures et des Mines. Investment is governed by the Investment Code of 1992 and Hydrocarbon Law 24/94 of August 23, 1994, which regulates the terms of production-sharing agreements. The Hydrocarbon Law reduced taxes on crude oil production to 12% from 17.5%, with the state-owned Société Nationale des Pétroles du Congo (SNPC) (formerly Hydro-Congo) participating in a 31% profit sharing on all production. Mining legislation is based on Decree No. 29/62 of June 1962, as amended by Decree No. 23/82 of July 7, 1982, and Decree No. 86/814 of June 11, 1986. In general, mining has been carried out by the state or through state-owned joint ventures. Prior to the breakout of the civil war in 1997, a new Mining Code had been presented to the National Assembly and Senate for consideration but was not acted on.

Commodity Review

Cement.— Scancem International ANS of Norway [a subsidiary of Heidelberg Zement International Holdings GmbH of Germany (70%)] owned Cimcongo S.A., which operated the Loutete cement plant near Pointe Noire. The plant had a production capacity of 250,000 metric tons per year (t/yr), or about 50% of domestic requirements. With the apparent end of civil strife, cement production increased to an estimated 100,000 metic tons (t) in 2001 from 20,000 t in 2000.

Copper, Lead, and Zinc.—AfriOre Ltd. of Canada held exploration permits on the Boko Songo copper prospect and the Yanga Koubanza lead-zinc-copper prospect, both of which are about 200 kilometers west of Brazzaville. Although the company was not active in the country during 2000 and 2001, it continued to seek potential joint-venture partners.

Gold.—In June, Arena Gold Resources Inc. of Canada and its partner Mining Italiana SpA of Italy decided to withdraw the offer to acquire a minimum 15% interest in the Yangadou gold mine in the Sangha region from S.E.M.I., S.A. of Congo (Brazzaville). S.E.M.I. was owned (70%) by United Gold Finance International (Arena Gold Resources Inc., 2001).

Magnesium.—Significant resources of magnesium in the Makola and Youbi magnesium salt evaporite deposits in the Kouilou region were being evaluated for development by Magnesium Alloy Corp. (MagAlloy) of Canada. The $514 million Kouilou Project would produce 60,000 t/yr of primary magnesium metal and high-purity magnesium alloys. As a byproduct of the magnesium operation, salt, potash, and possibly chlorine also would be produced. Magnesium metal is used in castings and wrought products and in aluminum-based alloys used in automobiles, packaging, and other applications. A 2004 startup was originally planned; by yearend 2001, however, MagAlloy was still seeking additional financing or a joint-venture partner to begin the implementation phase of the project (Magnesium Alloy Corp., 2001§). A description of the Kouilou project is available at the company Web site at URL http://www.magnesiumalloy.ca/project/ index.html.

Petroleum.—The Government maintained control over the petroleum sector with SNPC controlling the upstream petroleum exploration and production and Hydro-Congo controlling petroleum refining and distribution until October 2001. At that time, the transitionary Parliament passed a bill privatizing the

[1]References that include a section twist (§) are found in the Internet References section.

Digitized by Google

distribution and marketing of petroleum products and approved the sale of Hydro-Congo to a joint venture comprising TotalFinaElf S.A. and Shell Congo B.V. (Alexander's Gas & Oil Connections, 2001§). Hydro-Congo assets sold included the Congolaise de Raffinage oil refinery, which had a design capacity of 21,000 barrels per day (bbl/d) but had operated at only about one-half capacity prior to the war.

TotalFinaElf of France, which was the major private operator in the petroleum sector, operated under a production-sharing agreement with SNPC and had a 62% share in the country's total crude production of 262,000 bbl/d. TotalFinaElf was the operator of the Haute Mer permit and held a 51% production-sharing interest. Other partners included ChevronTexaco Corp. of the United States (30%), SNPC (15%), and Energy Africa Ltd. of South Africa (4%). During 2001, TotalFina Elf produced about 163,000 bbl/d from 279 wells in 7 oilfields, all but 1 offshore; the Nkossa Field, which was the largest, produced about 70,000 bbl/d and had remaining recoverable reserves of 500 million barrels (Mbbl) of oil. TotalFina Elf began producing at a rate of 40,000 bbl/d from the new Kombi and Likalala fields within the Pointe Noire Grand Fond (PNGF) permit and expected to invest $135 million to develop four other small fields by 2004. TotalFinaElf was also examining the potential of expanding production through the development of a number of oilfields discovered during the past 1 to 7 years; they included the Moho Field with reserves of 400 Mbbl of petroleum, the Bilondo Marine 1 Field, the Andromede Marine 1 well in the Mer Tres Profonde Sud permit, and several smaller fields within its PNGF concession (U.S. Energy Information Administration, 2002§).

Agip Congo S.A. (a subsidiary of Eni SpA of Italy) was the second largest petroleum operator, contributing about 27% of national petroleum, or about 72,000 bbl/d. Eni's principal oil-producing areas were in the offshore Loango, Zatchi, and Kitina oilfields. During 2001, Eni brought the Foukanda and the Mwafi offshore oilfields [Eni (65%) and SNPC (35%)] into production at a total cost of $217 million. On the basis of recoverable reserves of more than 50 Mbbl of oil equivalent, the Foukanda oilfield produced at a rate of 7,700 bbl/d in 2001 and will peak at a rate of 18,500 bbl/d in 2002. On the basis of recoverable reserves of more than 40 Mbbl of oil equivalent, the Mwafi oilfield produced at a rate of 6,150 bbl/d in 2001 and will peak at a rate of 13,800 bbl/d in 2002 (Eni SpA, undated§).

Total national reserves were reported to be 1.5 billion barrels of oil and more than 90 million cubic meters of natural gas. All gas output, however, was vented or flared owing to a lack of extraction and distribution infrastructure (U.S. Energy Information Administration, 2002§).

Outlook

During 2000 and 2001, Congo (Brazzaville) began the long process of restoring the Government, establishing a national dialog, adopting a new constitution, and resettling more than 800,000 people displaced during the war. The sharp upturn in oil prices and related revenues to the state along with renewed efforts to finance a major magnesium development suggested that the minerals sector could be a catalyst for economic renewal of the country. However, future development progress will be contingent on more transparency on government distribution of oil revenues and on continued political stability, which appeared threatened by renewed civil unrest in early 2002.

Reference Cited

Arena Gold Resources Inc., 2001, Arena appoints Louis-Marie Riopel as president: Arena Gold Resources Inc. press release, June 21, 1 p.

Internet References Cited

Alexander's Gas & Oil Connections, 2001 (October 9), Congo Republic adopts privatization bill for petrol products, accessed April 12, 2002, at URL http://www.gasandoil.com/goc/news/nta14190.htm.

Eni SpA, [undated], Congo—Foukanda and Mwafi projects, accessed April 12, 2002, via URL http://www.eni.it.

Magnesium Alloy Corp., 2001 (December 31), Fiscal year 2002—Third quarter report, accessed April 12, 2002, at URL http://www.magnesiumalloy.ca/finan/finan.htm.

U.S. Central Intelligence Agency, 2000, Republic of the Congo, World Factbook, accessed April 11, 2002, at URL http://www.odci.gov/cia/publications/factbook/geos/cf.html.

U.S. Energy Information Administration, 2002 (March), Congo-Brazzaville, Country Analysis Brief, accessed April 10, 2002, at URL http://www.eia.doe.gov/emeu/cabs/congo2.html.

Major Source of Information

Ministère des Hydrocarbures et des Mines
Service des Mines et de la Geologie
B.P. 2124
Brazzaville, Republic of Congo
Telephone: (242) 83 58 73
Fax: (242) 83 62 43

TABLE 1
CONGO (BRAZZAVILLE): PRODUCTION OF MINERAL COMMODITIES 1/

Commodity 2/		1997	1998	1999	2000	2001 e/
Cement, hydraulic	thousand metric tons	20	--	--	20	100
Gold, mine output, Au content e/	kilograms	10	10	10	10	10
Lime e/	metric tons	390	390	390	390	390
Liquid petroleum gas (propane)	thousand 42-gallon barrels	3,912 r/	4,384 r/	4,918 3/	5,000	5,000
Petroleum, crude	do.	85,424 r/	90,499 r/	93,951 3/	95,630	103,000
Petroleum, refined 4/	do.	1,355	--	--	1,200	3,800

e/ Estimated; estimated data are rounded to no more than three significant digits. r/ Revised. -- Zero.
1/ Includes data available through March 2002.
2/ Natural gas is also produced, but all of it is vented or flared.
3/ Reported figure.
4/ Oil refinery ceased operations at yearend 1997 and reopened April 2000.

Digitized by Google

THE MINERAL INDUSTRY OF

CONGO (KINSHASA)

By George J. Coakley

The Democratic Republic of the Congo [Congo (Kinshasa)] is located in the heart of equatorial central Africa and has an area of 2,267,600 square kilometers (km²), which is about one-fourth that of the United States. The area supported a population of about 53.6 million in mid-2001 with a gross domestic product (GDP) per capita of $600 based on 2000 purchasing power parity data (U.S. Central Intelligence Agency, 2002§[1]). Historically, the mining industry accounted for 25% of the GDP and about three-quarters of total export revenues. The International Monetary Fund (IMF), however, reported a drop in the mining sector's estimated share of the GDP in 2000 to 6% and an overall decline in the sector of 21% between 1996 and 2000 (International Monetary Fund, 2001b§, p. 48-49). Congo (Kinshasa) is richly endowed with such mineral resources as coal, cobalt, columbium (niobium) and tantalum (locally referred to as "coltan"), copper, diamond, germanium, gold, manganese, petroleum, tin, uranium, and zinc. Despite the collapse of much of the formal mining infrastructure, it is still an important world source of cobalt and industrial diamond (table 1).

The near collapse of the economy has made sustaining normal mining activities difficult; with some exceptions, most foreign exploration activity and development-oriented feasibility work came to a halt by the end of 1998. Following a 1-year hiatus, a new full-scale civil war broke out in August 1998. In July 1999, the so-called Lusaka cease fire agreement was signed by all parties involved in the civil war, but negotiations on its implementation were continuing into 2001. The resulting decrease in military conflict during 2001, however, was permitting the Government some opportunity to address other governance concerns, including a proposal for new foreign investment and mining laws.

A mid-2001 report by the IMF painted a gloomy picture of the economy, "characterizing the economic situation between late 2000 and mid-2001 as a vicious circle of hyperinflation, continued depreciation of the currency, increased dollarization and financial disintermediation, falling productivity, deterioration of the infrastructure, and general impoverishment of the population." Among other indicators, the IMF reported an average 5% decline in the GDP during the past 3 years, an external debt of $13 billion equal to 280% of the real GDP, and a growing gap in the difference between the official and parallel market currency exchange rates equal to 545% in May 2001. The IMF noted that the shrinking tax base was exacerbated by "the diversion of revenues from the budget, in particular from the public mining companies [La Générale des Carrières et des Mines (Gécamines) and Société Minière de Bakwanga (MIBA)], and the petroleum products sector ... to finance outlays outside the budget for sovereignty and security" (International Monetary Fund, 2001a§).

In November, the United Nations (U.N.) Security Council's panel of experts on the illegal exploitation of natural resources and other forms of wealth of Congo (Kinshasa) issued a followup report on its investigative findings. The panel of experts reported that, throughout the history of the country, its "precious resources were plundered and mismanaged, and an informal economy based on barter, smuggling and fraudulent trade in commodities thrived, becoming the sole means of survival for much of the population. Commerce is reinforced by preexisting ties based on ethnicity, kinship, and colonial structures between the Kivu Provinces and Burundi, Rwanda, Kenya, Uganda and Tanzania, and between Katanga Province and Zambia and Angola." The effective collapse of all state institutions and structure in Congo (Kinshasa) is a fundamental cause of the current pattern of resource exploitation. The panel of experts noted also that the flagrant violation of the basic human rights of the Congolese people is a far graver phenomenon than the exploitation of material resources.

The panel-of-experts report goes on to note the sharp market price decline and the institution of international sanctions, which sharply reduced revenues flowing to Rwanda generated by the illegal mining of coltan in 2001; the continued illegal artisanal exploitation of gold, particularly in the Kilo Moto area, by Ugandan interests; and efforts by the Government to transfer rich copper-cobalt assets within Gécamines central mine group to Zimbabwean interests to ensure the continued military support of Zimbabwe. With regards to the diamond sector, the report noted that data suggested that the small amount of high-value gem-quality diamond produced by MIBA was being embezzled; described the arrangements granting Zimbabwean interests 25-year exploitation rights to the Sengamines diamond concession near the Angolan border; described the taxation and illegal export routes of artisanal diamond produced in the Kinsangani area; and noted that as much as one-third of the estimated $300 million of total diamond production was illegally smuggled out of the country.

The panel of experts concluded that the cease-fire left the exploitation of natural resources as the main activity of the foreign troops as well as the different armed groups, thus creating a self-financing situation where one activity (continuation of the conflict) drives the other (exploitation of resources) whereby no real budgetary burden is borne by the parties involved. The panel of experts report ended with a number of institutional reform and financial and technical recommendations that included a review and revision of all

[1]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

commercial contracts issued between 1997 and 2001 to correct all irregularities and a moratorium for a set time period banning the purchase of all commodities originating in areas where foreign troops are present as well as in territories under the control of rebel groups (United Nations Security Council, 2001§).

Government Policies and Programs

Legislation has been passed relating to all aspects of the mineral industry. Article 10 of the April 1994 Constitution states that the soil and subsoil belong to the state. Prospecting, exploration, and exploitation were regulated by Ordinance No. 81-013 of April 2, 1981, and required permits from the Ministry of Mines and Energy.

With the assistance of the World Bank, a draft of a new Mining Code was expected to reach parliament by the end of January 2002. "It will allow for the creation of a framework of incentives conducive to private investment and will include: (i) a change in the Government's role from mining operator to mining regulator; (ii) the creation of a single investment agreement framework without agreements negotiated on a case-by-case basis; (iii) the introduction of a special tax regime for the mining sector, which is fair and equitable and without exemptions; and (iv) the option, under a clear and straightforward system, of issuing mining titles on a first-come-first-served basis, transparently managed by an automated mining register to minimize discretionary action by the Government. Pending approval of the new code by parliament and its subsequent publication, the Government will no longer sign investment agreements for mining projects governed by tax and investment regimes other than those established in the new code. Finally, certification of the origin of diamonds under the applicable UN resolution will begin no later than end-March 2002" (Mulongo and Ilanki, 2002§).

Production and Trade

Estimated production of mineral commodities as listed in table 1 remained flat during 2001 compared with that of 2000. Production of refined copper as reported by Gécamines stayed at the 21,000-metric-ton (t) level, or less than 5% of capacity; and refined cobalt output declined by 6% to 4,071 t. Formal production of diamond reported by MIBA increased by 43% to 6.2 million carats, and artisanal diamond production was estimated to be 12 million carats; actual figures are uncertain owing to the high level of smuggling and undocumented production. Crude petroleum production increased by 12% to about 31,600 barrels per day (bbl/d). Formal gold production was around 50 kilograms (kg); undocumented artisanal gold production in areas controlled by the rebel faction Rally for Congolese Democracy (RCD), however, could range from 3,000 to 6,000 kg. Likewise, reports of columbium (niobium)-tantalum concentrate production vary widely; the sharp drop in prices to a level more consistent with prior years at $39 per pound of tantalum in 2001 from the 2000 spike of $300 per pound, however, would make an estimate of about 200,000 kg of concentrate not unreasonable. Reliable trade data were not available. On the basis of average commodity prices for 2000, however, the value of mineral exports would be on the order of $1.3 billion to $1.9 billion depending on the average dollar per carat value assigned for diamonds. Historically, the main trading partners of Congo (Kinshasa) were Belgium, France, Germany, Japan, South Africa, and the United States.

Structure of the Mineral Industry

The Government maintained at least partial ownership and generally majority ownership of nearly all the productive and service sectors of the economy. Gécamines produced essentially all the country's coal, cobalt, copper, and zinc. It also operated subsidiaries that produced cement and other materials required for its primary mineral interests. MIBA (80% owned by the Government) produced about 25% of industrial diamond production from Government-controlled lands in Kasai Province with the remainder coming from small artisanal operators. The columbium (niobium)-tantalum, gold, and tin producer Société Zairoise et Industrielle du Kivu (Sominki) and the major gold producer Office des Mines d'Or de Kilo-Moto (Okimo) were the other principal parastatal mining companies. The majority of Sominki and Okimo holdings were in rebel-held areas in eastern Congo (Kinshasa).

During 1997 and for more than one-half of 1998, prior to the renewed outbreak of the current civil war, Gécamines used joint-venture agreements to attract the capital needed to revitalize operations. Under these agreements, foreign investors would retain up to 49% equity interest in the joint venture, most of which ranged from 20% to 45%. By the beginning of 1998, Gécamines had 23 cooperative projects, which included development of the Tenke-Fungurume deposits, that it hoped would return production levels of copper to 400,000 metric tons per year (t/yr) and cobalt to 25,000 t/yr. During 2000 and 2001, however, most of these projects were either on force majeure hold or proceeding cautiously with feasibility work.

Commodity Review

Metals

Copper and Cobalt.—Gécamines' holdings in the Copperbelt in Katanga Province contained one of the greatest concentrations of high-grade copper and coproduct cobalt resources in the world. Since 1993, most mining operations have come to a standstill with total capacity utilization at less than 10%. Gécamines faced multiple crises in finance, production, and transportation. The company's poor condition was attributed to a combination of aging equipment; lack of domestic and international investment; lack of spare parts; shortages of fuel, lubricants, and sulfuric acid; problems with transporting ore and finished products; theft of finished products; debts owed to the state electrical company and Société Interrégionale Zaïroise de Rail (Sizarail); flooding of open pit mines; and the inability to retain professional and other personnel because of disruptions caused by the war and other

Digitized by Google

factors. Gécamines' strategy for 2001 and 2002 was to concentrate development and mining activities at cobalt-rich zones of several copper ore bodies, with plans to produce 10,000 to 15,000 t of higher value cobalt by the end of 2002.

OM Group, Inc. (OMGI) (55%), of the United States, which was one of world's largest consumers of refined cobalt, and l'Enterprise Generale Malta Forrest SPRL (EGMF) (25%) completed the first major foreign investment in Katanga Province in recent years. Full operating capacity from their Luiswishi copper-cobalt mine was reached in 2000. The Luiswishi Mine, located about 25 kilometers (km) north of Lubumbashi, was the only mine operating in Gécamines' Southern Group during 2001. EGMF had completed mining of one small oxide deposit at Luiswishi by yearend 2001 with two oxide and one sulfide deposits remaining. During a visit to the mine in February 2002, the total resource that remained at Luiswishi was reported to be 7.5 to 8 million metric tons (Mt) at a grade of 2.8% copper and 1.0% cobalt. The second phase of mining will develop 3.5 Mt of oxide reserves at a grade of 2.5% copper and 1.0% cobalt at a rate of 500,000 t/yr of ore. The deposit was formed within dolomitic to argillaceous sediments with a talc-rich oxide ore that contains a high percentage of black oxides, which include a copper mineral bornite and cobalt minerals carrolite and heterogenite. The ore was being sent to the Kipushi concentrator for treatment. Between 5,500 and 6,000 t/yr of cobalt and up to 9,000 t/yr of copper contained in concentrates was being sent to OMG's Kokkola chemical plant in Finland for refining.

The $130 million Big Hill cobalt smelter in Lubumbashi was run by Le Societe pour le Traitement de la Terril de Lubumbashi (STL) [a joint venture between OMGI (55%), Gécamines (25%), and EGMF (20%)]. The smelter was treating an adjacent slag stockpile, that has been accumulating since 1920 and has been referred to as the "Big Hill," which was sufficient to supply the plant for 20 years. Slag grades were quite variable and remining was focused on the southern slopes of the Big Hill where grades ranged from 2.0% to 2.15% copper and 1.2% cobalt. The Big Hill also included zinc-bearing slags from processing of ores from the Kipushi Mine. The slag is gravity fed from the hilltop and blended to a consistent grade into two 14,000-t stockpiles, which represented 3 weeks of feed to the smelter at full capacity. The slag is dried in a rotary kiln by using coking coal from the Wankie Colliery in Zimbabwe. The material is then reduced in a large Outokumpu electric arc furnace. The power for the three-electrode 30-megawatt (MW) furnace was supplied from the Inga Dam transmission lines after being converted from direct to alternating current. The liquid metal is tapped and transferred to a second smaller 20-t furnace where it is cooled to 80° C and granulated to a fine (minus-800-millimeter) copper-cobalt alloy powder by pouring the hot liquid through a continuous water jet flow. Zinc offgases from the process are precipitated and recovered in a bag house and returned as zinc oxide pellets to Gécamines' electrowining plant at Kolwezi. The STL plant produced 2,000 t of cobalt contained in a powder alloy in 2001 with plans to double production to 4,000 t of contained cobalt in 2002 following a routine relining of the main furnace. The plant employed 650 workers during construction and 350 during operation. At full capacity, the STL plant can produce 5,000 t/yr of cobalt, 3,500 t/yr of copper, and 15,000 t/yr of zinc oxide. OMGI was committed to take the first 4,000 t/yr of cobalt from the plant, with an option to take the full production.

Following the successful exploration and discovery of the small, high-grade Lonshi copper deposit, First Quantum Minerals Ltd. of Canada obtained a 40-year mining concession from the Government of Congo (Kinshasa) and began open pit mining in September. The Lonshi Mine is located in the so-called pedicle extension of southeastern Congo (Kinshasa) into Zambia and only 35 km east of First Quantum's Bwana Mkubwa solvent extraction-electrowinning (SX-EW) plant in Zambia where the Lonshi oxide ore is trucked for treatment. Bwana Mkubwa has been converted from a tailings retreatment facility to a direct-feed oxide operation to accommodate the Lonshi ore. The Lonshi deposit, which is located within a 15-meter (m)-thick sequence of weathered Roan clastic sediments and dips 38° to the east, contains a measured and indicated resource of 5.1 Mt at a grade of 5.75% acid-soluble copper. The deposit remains open along strike and at depth. The company planned on mining 730,000 t of ore grading 5.45% copper during its December-2001-to-November-2002 fiscal year (First Quantum Minerals Ltd., undated§).

Anvil Mining NL of Australia and First Quantum [its minority (18.9%) partner] announced plans in July 2001 to develop the high-grade Dikulushi copper-silver deposit in southeastern Congo (Kinshasa) near the Zambian border west of Pweto and Lac Moero. The development was based on reported resources at Dikulushi of 1.94 Mt at a grade of 8.59% copper and 266 grams per metric ton (g/t) silver. Construction on the $5.7 million first stage of the project began in December 2001. The first stage will involve construction of an open pit, a heavy-media separation (HMS) plant, and barge and docking facilities to transport the concentrates down Lake Moero to Nchelenge from where it will be trucked to First Quantum's Mopani Copper Mines in Mufalira, Zambia, for further smelting and refining. The HMS plant will treat 250,000 t/yr of ore and produce 35,000 to 40,000 t/yr of concentrates grading 40% copper and 1,230 g/t silver. Toll-refined metal production will be approximately 14,000 t/yr of copper and 34 t/yr (1.1 million troy ounces per year) of silver. After finalizing project financing in March 2002, Anvil anticipated that the Dikulushi Project would be in production by August 2002. Anvil will use project cash flow to finance a Stage II development to add a ball mill, a flotation circuit to produce a concentrate at a grade of 60% copper and 1,935 g/t silver, and a Stage III development to move mine production underground (Anvil Mining NL, 2002a§, b§). Anvil also held a number of exploration licences that covered more than 43,000 km^2; these included gold and platinum prospects near Kalemie, copper and gold prospects near Kapulo, and copper prospects near Lungeshi.

Tenke Mining Corp. (TMC) of Canada (55%), in joint venture with Gécamines (45%), held the concession to develop the 1,437 km^2 Tenke Fungurume copper-cobalt deposits that are located within two concessions in Katanga Province approximately 175 km northwest of the city of Lubumbashi. A

Digitized by Google

description of the project is available at the company Web site (Tenke Mining Corp., 2000§). BHP Billiton plc of Australia held an option to acquire a 45% interest in the Tenke-Fungurume Project, and Phelps Dodge signed an agreement in May to earn up to 50% of BHP Billiton's option interest in the project. TMC reopened discussions with the Government during 2001, which were ongoing in 2002, regarding terms of developing the project and possibly renegotiating the terms of the mining convention held on the property.

In January, Kababankola Mining Company (KMC) was formed as a joint venture between the Government of Congo (Kinshasa) (68%) and Tremalt Ltd. of the United Kingdom (32%) (and Zimbabwe interests) to operate the Kakanda and the Kambove copper-cobalt mines in Gécamines' central mining group near Likasi. In a 25-year agreement, KMC acquired rights to the Kakanda and Kambove concessions and to export 200 metric tons per month of cobalt. Tremalt pledged $50 million in operating capital for KMC (Financial Gazette [Zimbabwe], 2001§). In early 2002, KMC was developing the high-grade cobalt oxide cap at the Mukondo copper-cobalt deposit by using the Zimbabwean contract mining firm Swanepoel with the subcontracting of mining equipment from Kombinat Gorniczo Hutniczy Miedzi Polska Miedz S.A. (KGHM) of Poland. The Mukondo deposit occurred along a 1.8-km-long strike length of an anticlinal fold structure that contains the central mine group sediments. During a February 2002 visit, resources were reported to be 1.8 Mt at a grade of 1.6% copper and 1.2% cobalt. High-grade zones of up to 4% cobalt contained in a black weathered heterogenite (a cobalt oxide mineral) were reported. Ore was being trucked to the Kakanda concentrator for treatment.

Société Minière de Kabolela et de Kipese (SMKK) [controlled by Melkior Resources Inc. of Canada (60%) and Gécamines (40%)] owned the Kabolela copper-cobalt mine and the Kipese cobalt-palladium-gold exploration property discovered by Melkior near Likasi. In December 1999, Melkior entered into a farm-in agreement with La Compagnie Financiere de Participations Internationales (Cofiparinter) whereby Cofiparinter could earn one-half of Melkior's interest or 30% in SMKK after the expenditure of $290,000. Melkior was also obligated to pay a net-profit royalty of 10% up to $1 million to Consolidated Trillion Resources Ltd. (Melkior Resources, 2002a). Work during the year was limited to further drilling, bulk sampling, and evaluation of earlier Gécamines resource estimates at Kabolela South where initial studies suggested the potential for developing a small-tonnage, high-value deposit that could be mined at a rate of 300 metric tons per day and could produce a minimum of 1,500 t/yr of cobalt contained in sulfide concentrates. On the basis of a 1970 drilling program, Gécamines reported near-surface resources at Kabolela of 3.7 Mt at a grade of 3.8% copper and 0.7% cobalt. Further work at Kabolela by SMKK was constrained by a lack of additional financial commitments. At Kipese, trenching work during 1998 indicated the occurrence of gold, palladium, and cobalt mineralization in a sheared vein system within copper bearing sediments, but apparently only limited followup work has been done (Melkior Resources Inc., 2002, p. 6-10).

Congo Mineral Developments Ltd. (CMD) was formed in 1998 as a 50-50 joint venture between American Mineral Fields Inc. (AMF) and Anglo American plc of the United Kingdom to operate the Kolwezi copper-cobalt tailings project in partnership (60%) with Gécamines (40%). AMF was a listed company on the Toronto [Ontario, Canada] Stock Exchange with headquarters in London, United Kingdom. In 1999, Umicore (formerly Union Minière) of Belgium acquired an 11% equity interest in AMF. During 2001, CMD renegotiated its agreement with Gécamines to allow for the development of the project in two phases. With an investment of $330 million in Phase I, the plant will treat approximately 3 million metric tons per year (Mt/yr) of tailings, which will yield up to 42,000 t/yr of copper and 7,000 t/yr of cobalt. Phase II would increase production capacity to 74,000 t/yr of copper and 14,000 t/yr of cobalt. The renegotiated agreement was awaiting ratification during 2002 under terms of the proposed new mining code. Under the agreement, CMD will pay Gécamines $25 million prior to construction and a further $10 million upon commissioning. When the agreement is ratified, a new operating company, KMT Sarl, will be formed by CMD and Gécamines. Between April 2000 and September 2001, the partners tested a 100-t bulk sample of Kolwezi tailings in a $4 million pilot plant in Johannesburg, South Africa, thus enabling the development of an optimum metallurgical flow sheet to produce high-grade copper and cobalt cathodes for the project. The Kolwezi Project is based on reprocessing of a resource of nearly 113 Mt at a grade of 1.49% copper and 0.32% cobalt of oxide tailings from the Kingamyambo (42.3 Mt) and Musonoi (70.5 Mt) tailings dams, accumulated from the Kolwezi area concentrators during a 40-year period. Mining would be by high-pressure water monitor guns with the material pumped along a slurry pipeline to a new leach SX-EW plant (American Mineral Fields Inc., 2002a§, b§).

Germanium.—In 2002, OMGI planned on beginning production of germanium oxide as a byproduct of the STL cobalt refining at Kokkola, Finland (OM Group, Inc., 2001, p. 10). When Gécamines was operating the Kipushi zinc mine and smelter at full capacity from the 1950s through the 1980s, Congo (Kinshasa) was the world's largest producer of germanium as a byproduct of zinc processing. Germanium oxide is used in fiber optic systems and in electronic and solar power applications.

Gold.—Société Aurifère du Kivu et du Maniema S.A.R.L. (Sakima) was established in January 1997 to operate the former Sominiki gold, tantalum, and tin mines and other land holdings in the region. Sakima was controlled by Banro Resource Corp. of Canada (93%) and the Government (7%). The old Sominiki holdings included 10 mining permits and 47 mining concessions that covered 10,271 km^2. Gold holdings southwest of Bukavu in Kivu Province included the Kamituga-Mobale underground gold mines, which were forced to close during the 1997 civil war, and the Lugushwa, Namoya, and Twanziga gold properties. In July 1998, however, without prior warning or consultation with Banro, the Government dissolved Sakima

Digitized by Google

through which Banro held its mineral properties and carried on business in Congo (Kinshasa), terminated the company's mining convention relating to the company's mineral properties, and created a replacement parastatal company, Société Minière du Congo S.A.R.L. (Somico). Following nearly 4 years of international litigation, the differences between Banro and the Government appeared to be resolved. In September 2001, Banro filed a request for judgement of default against Congo (Kinshasa) in the U.S. District Court, Washington, DC, under the terms of the U.S. Foreign Sovereign Immunities Act. In December 2001, Banro reached an agreement in principle with the Government of Congo (Kinshasa) for the return of the company's assets. In February 2002, Banro received an invitation from the Government to finalize implementation of the settlement agreement, and on April 18, 2002, the formal settlement agreement was signed, returning to Banro a 100% interest in the Kamituga, Lugushwa, Namoya, and Twanziga gold deposits and reviving its 30-year mining convention. The Government will retain 100% rights to the tin assets formerly held by Sominki (Banro Resources Corp., 2001a§, b§, 2002a§, b§).

In a joint venture with AngloGold Ltd. of South Africa, Barrick Gold Corp. of Canada held a 57,000-km^2 exploration concession near the Kilo-Moto goldfields in the Bunia area of northern Congo (Kinshasa) and adjoining Sudan to the north and Uganda to the east. During 2001, Ashanti Goldfields Co. Ltd. of Ghana increased the size of its holdings to 6,000 km^2 from 2,000 km^2 in the Kilo-Moto Mining International S.A.R.L. (Kimin) concession, which covered most of the historically productive greenstone belt in the rebel-controlled Eastern Province. Owing to the civil unrest in the region, Ashanti and Barrick conducted no substantive field activity on these holdings during 2000 or 2001.

Zinc.—In January 2002, AMF signed an agreement with Zincor Ltd. [a subsidiary of Kumba Resources of South Africa (formerly the mining arm of Iscor Ltd.)] that governed the rehabilitation of the Kipushi zinc mine. Zincor will obtain a 50% interest in the project by investing up to $3.5 million to prepare a bankable feasibility study for a small-scale project to produce zinc concentrates. AMF and Kumba will form a joint-venture company, Zincongo Ltd., to negotiate a framework agreement with Gécamines to govern redevelopment of Kipushi. Scoping studies during 2001 concluded that mining operations of up to 100,000 t/yr of zinc contained in concentrate could be sustained for 20 years, subject to adequate commodity prices. Originally started in 1929, the Kipushi Mine ceased full-scale mining in 1993 but has been maintained in excellent condition with ongoing dewatering at the rate of 2,000 cubic meters per hour. Up to 1,700 t/yr of contained zinc was produced between 1994 and 2001. The aboveground infrastructure requires total rehabilitation. The bulk of measured and indicated mine resources remaining for development were between the 1,150-m and 1,500-m levels and amounted to 17 Mt at a grade of 16.7% zinc and 2.32% copper. An additional inferred resource between the 1,500-m and 1,800-m levels was reported to be 9 Mt at a grade of 23.3% zinc and 1.93% copper. AMF described the Kipushi deposit as being centered on a hydrothermal polymetallic replacement vein system, 40 to 60 m wide, associated with a set of intersecting faults. The main vein is between an Upper Kundelungan series shale hanging wall and a Lower Kundelungan series dolomitic footwall. The ore is mineralogically zoned both laterally and vertically with copper predominating in the north and at the top and zinc strongly enriched (up to 24% zinc) in the south and at depth (American Mineral Fields Inc., 2002a§, c§).

Industrial Minerals

Diamond.—MIBA accounted for about one-quarter of the total national production of diamond from mining operations in Mbuji Mayi in Kasai Province. MIBA was owned by the Government (80%) and Sibeka Group (20%) [owned by Unicore (79%) and De Beers Centenary AG (20%)]. MIBA reported production at 6.2 million carats of low-value, near-gem quality stones in 2001; this was an increase of 43% compared with that of 2000. Investigations by the U.N. panel of experts, however, suggested that nearly one-half of the 4% of MIBA diamond production that is of near-gem or gem quality was being illegally smuggled to South Africa for onward sale and that millions of dollars of MIBA diamond sales revenues were being misappropriated (United Nations Security Council, 2001§, p. 9).

In another apparent repayment for foreign military support, MIBA's rich Senga-Senga River diamond concession (Sengamines) was spun off by the Government during 2000 as a 25-year joint venture between the Congolese company COMIEX-Congo and the Zimbabwe Defence Forces-owned Operation Sovereign Legitimacy (COSLEG). The 550-km^2 Sengamines concession within the Mbuji-Mayi region includes the Tshibua kimberlite pipe and six alluvial fields. COMIEX was a state-private venture used by the Government as a platform for commercial deals. According to the U.N. panel of experts report, the resulting joint venture, COSLEG, had neither the capital nor the technological expertise to run the Sengamines concession, and a third party, Oryx Natural Resources (a British-Omani company), was brought in to help in exchange for a 49% equity interest in COSLEG. Oryx, in turn, set up another Congo (Kinshasa)-Zimbabwe-based joint venture, Oryx-Zimcon, to manage the financial and technical end of the project (United Nations Security Council, 2001§, p. 10). The company was actively developing the property at yearend 2001.

In July 2000, the Government signed an agreement with International Diamond Industries (IDI) of Israel that gave the company the exclusive right to export diamonds from state-owned mining operations in return for a payment of $20 million. After currency controls failed to halt the smuggling of diamond, the Government felt this arrangement would more effectively control the security and the origin of diamond production from Congo (Kinshasa), to distinguish them from illegally mined "conflict" diamonds (Namibian, 2000§). In April 2001, the Government revoked IDI's exclusive monopoly on diamond exports and reestablished an open-bidding and free market sales and export system for diamond. The action was

Digitized by Google

designed to reduce the smuggling that occurred under the monopoly system (Knickmeyer, 2001§).

Mineral Fuels

ChevronTexaco Oil Congo (DRC) Ltd. [owned by ChevronTexaco Corp. of the United States (50%), Teikoku Oil Co. Ltd. of Japan (32.3%), and Unocal Corp. of the United States (17.7%)] was the country's major producer with an average net crude oil output of 8,900 bbl/d from eight offshore wells in 2001. During 2001, ChevronTexaco completed one development well in the Tshiala Field and five delineation wells—one each in the Libwa, Lukami, and Misato Fields and two wells in the GCO Field (ChevronTexaco Corp., 2002§). The only domestic oil refinery, which was at Muanda, had a rated capacity of 17,000 bbl/d.

Other companies that were operating in Congo (Kinshasa) included Japan National Oil Co., PanAfrican Energy Corp. Ltd. of Canada (a subsidiary of Pan-Ocean Energy Corp. Ltd. of Jersey, United Kingdom, formerly known as Ocelot International Ltd.), and Shell-Lirex (a subsidiary of Shell Petroleum N.V.). During 2001, PanAfrican Energy terminated its arrangement to purchase a nonoperated production interest from Shell in Congo (Kinshasa) because Shell-Lirex was unable to obtain the necessary Government approvals. The three Shell onshore concessions—East Mibale, Liawenda-Kinkasi, and Muanda-Banana—included six established fields near the mouth of the Congo River. The concessions had been in production since 1980, and remaining proven recoverable reserves were estimated to exceed 32.5 million barrels (Mbbl) of oil (PanAfrican Energy Corp. Ltd., undated§; Pan-Ocean Energy Corp. Ltd., 2002§).

Reserves

Major mineral resources were generally considered to be sufficient for many years of production with known copper ore grades running two to eight times the grade of typical copper ore mined in North America and South America. In February 2002, Gécamines reported total "global reserves" of 54 Mt of copper, 4.66 Mt of cobalt, and 6.4 Mt of zinc, expressed in contained metal. The global reserves included proven, possible, and probable in situ material and metal contained in tailings and slag. Gécamines also indicated that the global reserve data were based on old work and needed to be reevaluated in terms of currently accepted world industry practices for reporting identified mineral resources and ore reserves (La Générale des Carrières et des Mines, 2002). Reserves of oil, gas, and coal were estimated to be 187 Mbbl, 1 billion cubic meters, and 88 Mt, respectively (U.S. Energy Information Administration, 2001§).

Infrastructure

Congo (Kinshasa) is an essentially landlocked country with only a small coastal area on the Atlantic Ocean. The main port of Matadi, which has a 160-km river approach, has had difficulty operating at its 2-Mt/yr cargo capacity. Waterfalls below the capital of Kinshasa make the Congo River unnavigable to the sea and limit the world's second largest river as a significant export route, although it is a key inland commercial route.

A combination of air, railroad, road, and riverboat transport was used to move equipment, food, and other supplies into the mining and mineral-processing regions and for exporting ores, concentrates, and finished mineral products. Even prior to the breakout of civil war, much of this transport network was in varying degrees of disrepair. Locomotive and rolling stock shortages were also a problem. Sizarail was a critical logistical support link for the diamond industry between the Zambian border and Mbuji Maya.

The majority of companies involved in transportation were Government owned. Small private trucking and river boat companies provided limited local service. Historically, mineral products were shipped from the Copperbelt on one of three routes. The completely internal western route was via the Voie Nationale, which was a difficult road-rail-water route from the Copperbelt to the port of Matadi, south of Kinshasa. The eastern route went through Zambia on the Tazara railroad to the port of Dar es Salaam in Tanzania, and the southern route, through Zambia on rail lines that led to bulk-loading export ports in South Africa. Copper shipments could take 45 days to get from the plant to the dock either south via Zambia and Zimbabwe or eastward along the Tazara railroad via Zambia and Tanzania. Owing to rail and river transport problems, most cobalt and copper wirebar products were shipped via truck convoy to the port of Durban in South Africa. High-value cobalt, diamond, and gold were commonly flown out of the country.

Katanga Province, which is the site of most of the country's mining activity, historically consumed almost 50% of the nation's generated electrical power. A portion of the electricity used in the Katanga region was delivered by the 1,800-km-long, 560-MW Inga-Shaba transmission line, which runs from the Inga Dam on the Congo River south of Kinshasa to the Copperbelt city of Kolwezi in Katanga Province. In 1999, about 5 billion kilowatthours of electricty was produced, chiefly from hydrolectric powerplants; nevertheless, the tremendous hydroelectric potential of the Congo River remained largely untapped. For energy requirements at its mine and metallurgical operations, Gécamines was dependent on imported coke and refined petroleum products.

Outlook

Renewed Government efforts during 2001 to reestablish relations with the World Bank and the IMF and to begin to rebuild state institutions were positive signs for the future. Congo (Kinshasa), however, was still struggling to resolve the ongoing civil war, to reestablish a central Government recognized nationally, and to resolve refugee problems and ethnic conflicts in the eastern provinces that border Rwanda and Uganda. The decline of copper and cobalt production during the 1990s has led to the deterioration of Gécamines, which is the country's most important company. Despite almost

Digitized by Google

insurmountable operating difficulties, Gécamines continued to operate, albeit at limited capacity. Changing Government policies that promote privatization of the state-run mining sector and stronger guarantees of property title and investment security by the Government, which included the new mining law proposed for 2002, will help to attract the new foreign capital and technical expertise needed to redevelop the country. Lack of transparency in business transactions with the Government and weak legal structures remain problems. Because of its size and wealth of resources, the long-term potential of Congo (Kinshasa) was more promising, and the country could return to world markets as an important supplier of cobalt, copper, diamond, and zinc. The future prospects for economic development of Congo (Kinshasa) depended on its ability to achieve political and economic stability and to put in place the legal and business framework needed to attract new foreign investment.

References Cited

La Générale des Carrières et des Mines, 2002, La Générale des Carrières et des Mines: Lumumbashi, Congo (Kinshasa), U.S. Geological Survey delegation visit, February 4, Presentation, 14 p.

Melkior Resources Inc., 2002, Notice annuelle—Relative à l'exercise terminé le 30 Août 2001: Montreal, Quebec, Canada, Melkior Resources Inc., January 24, 18 p.

OM Group, Inc., 2001, Annual report of OM Group, Inc., for 2000: Cleveland, Ohio, OM Group, Inc., March 16, 24 p.

Internet References Cited

American Mineral Fields Inc., 2002a (February 11), Annual report for 2001, accessed May 20, 2002, at URL http://www.am-min.com.

American Mineral Fields Inc., 2002b, Projects—Kolwezi tailings, accessed May 20, 2002, at URL http://www.am-min.com.

American Mineral Fields Inc., 2002c, Projects—Kipushi, accessed May 20, 2002, at URL http://www.am-min.com.

Anvil Mining NL, 2002a (April 23), Dikulushi copper-silver project—DRC, accessed May 20, 2002 at URL http://www.anvil.com.au/projects/avlproj_dik.htm.

Anvil Mining NL, 2002b (March 18), Agreed for development of Dikulushi, Press Release, accessed May 20, 2002, at URL http://www.anvil.com.au/media/avl180302.htm.

Banro Resources Corp., 2001a (September 25), Banro files for judgement, Press Release, accessed May 20, 2002, at URL http://www.banro.com/releases/09-25-01.html.

Banro Resources Corp., 2001b (December 21), Banro reaches agreement with DRC, Press Release, accessed May 20, 2002, at URL http://www.banro.com/releases/12-21-01.html.

Banro Resources Corp., 2002a (February 11), Banro receives invitation to implement settlement agreement, Press Release, accessed May 20, 2002, at URL http://www.banro.com/releases/02-11-02.html.

Banro Resources Corp., 2002b (April 19), Banro reaches agreement with DRC, Press Release, accessed May 20, 2002, at URL http://www.banro.com/releases/04-19-02.html.

ChevronTexaco Corp., 2002, ChevronTexaco Corp. annual report for 2001, accessed May 28, 2002, at URL http://media.corporate-ir.net/media-files.

Financial Gazette [Zimbabwe], 2001 (March 28), Zim tycoon in $2.8b deal with the Congo, accessed May 22, 2002, at URL http://www.fingaz.co.zw/fingaz/2001/March/March21/1168.shtml.

First Quantum Minerals Ltd., [undated], Copper operations—Lonshi, accessed May 20, 2002, at URL http://www.first-quantum.com.

International Monetary Fund, 2001a (July), The Democratic Republic of Congo—2001 article IV consultation and discussions on staff-monitored program, IMF Country Report No. 01/114, accessed April 20, 2002, at URL http://www.imf.org/external/pubs/cat/longres.cfm?sk=15241.0.

International Monetary Fund, 2001b (July), The Democratic Republic of Congo—Selected issues and statistical appendix, IMF Country Report No. 01/123, accessed April 20, 2002, at URL http://www.imf.org/external/pubs/cat/longres.cfm?sk=15260.0.

Knickmeyer, Ellen, 2001 (April 21), Congo cancels Israeli-diamond supply, Associated Press, accessed May 23, 2002, at URL http://www.globalpolicy.org/security/issues/congo/2001/0421diam.htm.

Mulongo, J.C.M., and Ilankir, M.M., 2002 (January 14), Democratic Republic of the Congo, Letter of Intent to the International Monetary Fund, accessed April 30, 2002, at URL http://www.imf.org/External/NP/LOI/2002/cod/01.

Namibian, 2000 (August 9), DRC gives diamond monopoly to Israelis, accessed September 2, 2000, via URL http://www.namibian.com.na.

PanAfrican Energy Corp. Ltd., [undated], Democratic Republic of Congo, Asset portfolio—Operations overview, accessed May 28, 2002, via URL http://www.panafricanenergy.com/assets/assef.html.

Pan-Ocean Energy Corp. Ltd., 2002 (February 22), Panocean updates operational activities, Press Release, accessed May 28, 2002, at URL http://www.panoceanenergy.com/news/2002/2002_27_feb.html.

Tenke Mining Corp., 2000, Projects—Tenke Fungurume, accessed April 10, 2002, via URL http://www.tenke.com.

United Nations Security Council, 2001 (November 13), Addendum to the report of the panel of experts on the illegal exploitation of natural resources and other forms of wealth of the Democratic Republic of the Congo, Letter From the Secretary General to the President of the Security Council, accessed April 1, 2002, at URL http://ods-dds-ny.un.org/doc/UNDOC/GEN/N01/630/01/PDF/N0163001.pdf?OpenElement.

U.S. Central Intelligence Agency, 2002, Democratic Republic of the Congo, World Factbook, accessed April 26, 2002, at URL http://www.odci.gov/cia/publications/factbook/geos/cg.html.

U.S. Energy Information Administration, 2001 (February), Southern African Development Community, accessed April 8, 2002, at URL http://www.eia.doe.gov/emeu/cabs/sadc.html.

Major Source of Information

Ministère des Mines
3ème Niveau, Building Gècamines
Boulevard du 30 Juin
Kinshasa/Gombe,
République Démocratique du Congo
Telephone: (243)-(12)-21-538
Fax: (243)-(12)-21-607

Digitized by Google

TABLE 1
CONGO (KINSHASA): PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000	2001
METALS						
Cobalt:						
Mine output, Co content e/ 3/		3,500	5,000 r/	6,000 r/	7,000 r/ e/	4,700
Metal, Co content 4/		2,808 r/	4,490 r/	5,180	4,320	4,071
Columbium and tantalum:						
Columbite-tantalite concentrate:						
Gross weight		NA r/ 5/	NA r/ 5/	NA r/ 5/	450 r/ e/	200 e/
Nb content e/		NA r/	NA r/	NA r/	130 r/	60
Ta content e/		NA r/	NA r/	NA r/	130 r/	60
Copper:						
Mine output, leaching (electrowon)		39,651	34,994	32,000 r/ e/	21,000 e/	20,988
Metal:						
Smelter, primary, electrowon (low grade)		40,000	40,000	32,000 e/	21,000 e/	20,988
Refinery, primary, electrolytic		37,658	38,236	31,225	20,500	21,000 e/
Gold	kilograms	394 6/	151 6/	207 6/	52	50 e/
Silver e/	do.	500	--	--	--	--
Steel	thousand metric tons	248	118	87	80	80
Zinc, mine output, Zn content		1,660 6/	1,147 6/	-- 6/	215	1,014
INDUSTRIAL MINERALS						
Cement, hydraulic		124,929 6/	134,324 6/	171,210 6/	96,000	100,000
Diamond: 7/						
Artisanal	thousand carats	15,558	19,252	15,328	13,200 e/	12,000 e/
MIBA 8/	do.	6,328 r/	6,443 r/	4,732 r/	4,328 r/	6,200
Total	do.	21,977 6/	26,083 6/	20,116 6/	17,700 e/	18,200
Lime e/		50,000	25,000	25,000	25,000	25,000
Stone, crushed e/		200,000	100,000	100,000	100,000	100,000
Sulfuric acid e/		90,000	92,000	95,000	80,000	80,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous e/		5,000	5,000	--	--	1,000
Petroleum:						
Crude	thousand 42-gallon barrels	10,146 6/	9,444 6/	8,650 6/	10,300	11,500 e/
Refinery products:						
Liquefied petroleum gas	do.	1	4	4	4 e/	4
Gasoline	do.	89	434	431	431 e/	431
Kerosene	do.	90	340	340	340 e/	340
Jet fuel	do.	45	175	180	180 e/	180
Distillate fuel oil	do.	90	457	460	460 e/	460
Residual fuel oil	do.	280	874	880	880 e/	880
Refinery fuel and losses 9/	do.	135	200	205	205 e/	205
Total	do.	730	2,484	2,500	2,500 e/	2,500

e/ Estimated. r/ Revised. NA Not available. -- Zero.

1/ Estimated data are rounded to no more than three significant digits; may not add to totals shown.

2/ Table includes data available through April 2002.

3/ Includes mine production and reprocessed tailings.

4/ Salable refined production only; excludes white alloy, matte.

5 Columbite-tantalite concentrates are produced by artisanal miners, but data on production are speculative and unreliable for estimating.

6/ Reported data for 1997-1999 from Central Bank report: Economic activity--Volume of production--Mining and metallurgical production, August 2000.

7/ An estimated 20% of total diamond production is gem quality.

8/ Société Minière de Bakwanga, 80% owned by Government.

9/ Includes "Other."

Digitized by Google

THE MINERAL INDUSTRIES OF

CÔTE D'IVOIRE, GUINEA, LIBERIA, AND SIERRA LEONE

By Philip A. Szczesniak

CÔTE D'IVOIRE

In 2001, Côte d'Ivoire's production of minerals represented a minor component of its national economy, which had a gross domestic product (GDP) of $29.63 billion based on 2001 purchasing power parity data (International Monetary Fund, 2002§[1]). Agriculture was the leading sector in the economy, accounting for 29% of the GDP in 2000. In 2000, Côte d'Ivoire's population was estimated to be about 16 million (World Bank, 2001a§). The country was one of the world's largest producers of cocoa beans, coffee, and palm oil. Although mineral production was modest, offshore hydrocarbon production remained an important domestic source of energy. Côte d'Ivoire had proven deposits of bauxite, cobalt, copper, diamond, gold, iron, manganese, nickel, and tantalite (Mining Journal, 2001a). A number of companies were actively operating on exploration permits in 2001.

Despite electing a new President at the end of 2000, civil unrest continued in 2001. The Ministère des Ressources Minières et Pétrolières is responsible for the administration of the mining sector. All mineral rights are vested in the State. Exploration permits are valid for 3 years and can be renewed twice in consecutive periods of 2 years. Upon each renewal, the permit surface area is reduced by one-half. Upon discovery of deposits, an exploitation permit may be awarded for a period of time not exceeding 20 years. Such a permit must be held by a corporation registered in Côte d'Ivoire of which the Government holds a 10% free-carried interest. During the exploitation stage, corporations are exempted from tax for the first 5 years of financial operations. Thereafter, they are subject to a tax of 35% on profits. An ad valorem tax of 3% on precious metals is payable on a quarterly basis on revenues (Resource Information Unit, 2002, p. 77).

In 2001, the Governments of seven countries in western Africa agreed to form a free-trade zone. The countries included Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali, Niger, and Nigeria. According to the Minister of Co-operation and Integration in Africa, the agreement will work towards expanding the economic and infrastructural development in the region (Guardian Online, 2001§).

In May, Etruscan Resources, Inc., of Canada agreed to purchase all the Côte d'Ivorian gold assets of Diversified Minerals Resources NL of Australia; these included the Agbaou, Hiré, Loho, and Sirasso permits. The Agbaou permit has had the most exploration, and its resources are more than 26,000 kilograms (kg) (reported as 847,000 ounces) (African Mining Bulletin, 2001).

In December, Normandy Mining Ltd. of Australia sold its 51% holdings in the Ity gold mine to Cie Generale Des Matieres Nucleaires Group (COGEMA) of France for $10.8 million; the state-owned Société d'Etat pour le Développment Minier controlled the remaining 49%. In 2001, the Ity gold mine, which was the largest gold mine in Côte d'Ivoire, produced about 1,500 kg of gold (Metal Bulletin, 2001b). The Angovia gold mine also produced about 1,500 kg of gold in 2001; it was owned by COGEMA through its subsidiary Compagnie Francaise de Mines et Metaux (COGEMA Group, 2000§).

Other companies with gold interests in Côte d'Ivoire were Ashanti Goldfields Co. Ltd. of Ghana, Durban Roodepoort Deep Ltd. of South Africa, Eden Roc Mineral Corp. of Canada, Equigold NL of Australia, Jandera Resources NL (a subsidiary of Diversified Mineral Resources NL of Australia), North Ltd. of Australia, Randgold Resources Ltd. of the United Kingdom, and Shield Equities Ltd. of Australia.

Although kimberlites were known to exist at Kaniangone, Seguela, and Tortiya, diamond was produced only from the alluvial deposits at Seguela and Tortiya. Carnegie Minerals Ivory Coast S.A.R.L. (CMIC) [a joint venture of African Mining and Petroleum Resources plc (75%) and the state-owned Société d'Etat pour le Développment Minier de la Côte d'Ivoire (SODEMI) (25%)] explored the Bobi concession, which included the Toubaboukou dyke. The Director General of SODEMI noted that the Government was planning to implement a diamond certification scheme to respond to worldwide concerns over conflict diamonds (Mining Journal, 2001b).

Iron ore deposits in Côte d'Ivoire were at Monogaga, Mount Gao, Mount Klahoyo, Mount Nimba, Mount Segaye, Mount Tia, and Mount Tortro (Mines98, 1998a§). The country's total iron ore resource was estimated to be 3,000 million metric tons (Mt). Poor infrastructure has been a problem in pursuing the development of these resources; recently, however, there has been some interest in constructing a gas pipeline to service an iron ore pelletizing plant onsite and developing a rail link between Mount Nimba to the port of San Pedro (MBendi Information Services (Pty.) Ltd., 2000a§).

Falconbridge Ltd. of Canada continued evaluation of its Touba-Biankouma license. The property contains a laterite deposit of nickel and cobalt that was estimated to be 292 Mt of ore at a grade of 1.46% nickel and 0.11% cobalt (MBendi Information Services (Pty.) Ltd., 2000b§). In 2000, Consolidated Trillion Resources Ltd. of Canada sold its 15%

[1]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

interest in the license to Falconbridge for $2.5 million (Consolidated Trillion Resources, 2000§). Falconbridge officials noted that the project was still in an early stage and future development would depend on three things—construction of a proposed 500-kilometer (km) railway between San Pedro and Biankouma; an energy source, potentially from an offshore oil and gasfield; and political stability (Mining Journal, 2001b).

The largest gasfield in Côte d'Ivoire was the Foxtrot on offshore block CI-27. The gasfield was operated by France's Bouygues Group and was owned by a consortium made up of the state-owned La Société Nationale d'Operations Pétroliéres de la Côte d'Ivoire (Petroci) (40%); Mondoil Côte d'Ivoire (24%) (a subsidiary of Mondoil of the United States); SAUR Energies Côte d'Ivoire (24%) (a subsidiary of SAUR International of France); and Electricité de France/Gaz de France Group (12%) (Africa Energy and Mining, 1999). In 2001, 700 million cubic meters (reported as 68 million cubic feet per day) of gas were produced from the Foxtrot Field; reserves were estimated to be about 18 billion cubic meters (reported as 650 billion cubic feet). The Lion and Panthere gasfields located on offshore block CI-11 produced 510 million cubic meters (reported as 49 million cubic feet per day) of gas in 2001. This gasfield was owned by a consortium of Ocean Energy, Inc., of the United States and Petroci (Africa Energy Intelligence, 2002; MBendi Information Services (Pty.) Ltd., 2000c§). Total gas reserves for Côte d'Ivoire were estimated to be 30 billion cubic meters (reported as 1,050 billion cubic feet) (Oil & Gas Journal, 2001).

After being shut down in 1998 owing to high operating costs, plans were made in 2001 to redevelop the Espoir oilfield and gasfield. A partnership made up of Petroci, Ranger Oil Ltd. of Canada, and Tullow Oil plc of the United Kingdom planned to bring the field back into operation in 2002 (Africa Energy Intelligence, 2001a). Total oil reserves for Côte d'Ivoire were estimated to be 100 million barrels (Oil & Gas Journal, 2001).

Among the other companies with oil and gas interests in Côte d'Ivoire were Addax Petroleum NV (a subsidiary of Addax and Oryx Group of the United Kingdom), CNR International Ltd. (previously Ranger Oil) of the United Kingdom, Dana Petroleum plc of the United Kingdom, Oranto Petroleum Co. of Nigeria, Santa Fe Energy Resources, Inc., of the United States, and Vanco Energy Co. of the United States.

The Government announced its intention to privatize 26 state-owned companies. Among them was Société Ivoirienne de Raffinage (SIR), which was Côte d'Ivoire's oil refinery. The Government planned to sell 37% of its 47.25% holding in SIR. The Government of Burkina Faso owned 5.39% equity interest in SIR, and the remainder was held by subsidiaries of Elf Aquitane Group of France, ExxonMobil Corp. of the United States, Royal Dutch/Shell Group of the Netherlands and the United Kingdom, Texaco, Inc., of the United States, and TotalFina Elf Group of France. SIR had a refining capacity of about 21 million barrels per year [reported as 3 million metric tons per year (Mt/yr)] and mainly refined crude oil from Nigeria (Alexander's Gas & Oil Connections, 1999§). The December 24, 1999, military coup d'état resulted in the indefinite postponement of the SIR privatization (Africa Energy and Mining, 2000a).

Although Côte d'Ivoire faces similar infrastructure obstacles as the rest of the countries in West Africa, its network of 8,000 paved roads and 2 active ports make it attractive for business. Continued infrastructure developments in the future, especially the proposed 500-km railway between San Pedro and Biankouma would help open up the undeveloped mineral and energy resources; after having seen no sign of progress on this project for several years, the current Government was seen to be actively pursuing this $500 million railroad project.

GUINEA

In 2001, Guinea's production of minerals represented a major component of its national economy, which had a GDP of $16.31 billion based on 2001 purchasing power parity data (International Monetary Fund, 2002§). Mining accounted for about 16% of the GDP and about 90% of exports, most of which were bauxite. In 2000, Guinea's population was estimated to be about 7.4 million (World Bank, 2001b§). In 2001, Guinea was the world's second largest bauxite producer and had the world's largest bauxite resources (Plunkert, 2002a); bauxite accounted for about 90% of Guinea's exports. Guinea supplied about 32% of the United States' metallurgical-grade bauxite imports in 2001; this was down from 39% of bauxite imports in 2000 owing to an increase in imports from Jamaica (Plunkert, 2002b, p. 1). In addition to possessing significant bauxite reserves, Guinea has diamond, gold, granite, and iron ore deposits. The Government encouraged foreign participation in the bauxite sector and promoted the diversification of the mineral industry.

The Ministère des Mines, de la Géology et de l'Environment is responsible for the administration of the mining sector. The Centre de Promotion et de Developpement deals with all aspects of investment in the mining sector. The Government reserves 15% free equity for itself in all gold and gem operations. State participation in bauxite- and iron-ore-mining ventures is subject to negotiation. Mineral beneficiation in Guinea is encouraged. Royalties are 5% on alumina and 3.5% on concentrates of other minerals compared with 10% on bauxite and 7% on other ores. The corporate income tax rate was 35%.

Five different mining titles are listed in the Guinean Mining Code—reconnaissance permits last 3 to 6 months and allow prospecting of areas not under permit; exploration permits are valid for 3 years, are renewable for 4 years, and cover a maximum of 500 square kilometers; exploitation permits on areas defined by a feasibility study grant exclusive rights to minerals for 10 years and are renewable for 5-year periods; mining concessions reserved for large ore deposits as defined by a feasibility study are of 25 years duration and renewable for 10-year periods; and artisanal mining is allowed only to Guinean nationals on consigned areas (Resource Information Unit, 2002, p. 132).

In 2001, the French Government announced that it had awarded to Guinea a $1.3 million grant under the French overseas development fund Fonds de Solidarite Prioritaire. The grant will be managed by the Agence Francaise de Developpement and will go toward achieving the following three goals: improving Guinea's geologic and mining

Digitized by Google

information system, completing a geologic map of the central part of the country (an area covering 58,000 square kilometers), and funding training programs in Guinea and France (Africa Mining Intelligence, 2001a).

Compagnie des Bauxites de Guinée (CBG), which was the largest bauxite producer in the world, operated a number of open pit bauxite mines, which included the Bidikou, Sangarédi, and Silidara. CBG had a capacity of 14 Mt/yr and was controlled by the Government (49%) and Halco Mining, Inc. (51%), which was a consortium comprising Alcan, Inc., of Canada, Pechiney of France, and Alcoa, Inc., of the United States. CBG had additional resources at the Boundou Waade, N'danga, and Paravi deposits. Total existing reserves are estimated to be more than 300 Mt at a grade of 51% Al_2O_3; these are sufficient to support production at current rates for at least 25 years (Mining-Technology.com, undated§).

In April 2001, Russian Aluminium Co. (Rusal) of Russia announced that it had signed an agreement to manage the production facilities of Guinea's state-owned Société de Bauxite de Kindia (SBK). The agreement granted Rusal the right to manage SBK for 25 years. Company officials noted that they planned to invest $40 million on SBK within 3 years and an additional $40 million on expanding the main consumer of Guinea's bauxite, its Nikolayevsky Aluminum Plant facilities in Russia. Bauxite production at the Kindia bauxite mine is expected to grow from 1.5 Mt/yr to 2.5 Mt/yr during the next 3 years (metals-Russia.com, 2001§).

In 2000, Guinea Aluminum Products Corp. of the United States signed a memorandum of understanding with the Guinean Government for the construction and operation of an alumina refinery. The facility would involve investment of $1.5 billion with an operating capacity of 240,000 metric tons per year (t/yr) (boubah.com news service, 2000§).

In June, Alumina Co. of Guinea [75% controlled by Guinea Investment Co., which was owned by the United Kingdom metals investment and trading group Manro Haydan; 15% by the Guinean Government; and 10% by Alcoa (via takeover of Reynolds Metal Co.)] announced that it had increased alumina production at its Friguia refinery by 150,000 t/yr to 700,000 t/yr (Metal Bulletin, 2001a).

In 2000, the Government awarded Semafo, Inc., of Canada a 10-year mining license for the Jean Gobele gold project. Construction of the Kiniero open pit gold mine began in early 2001, and the mine officially opened in early 2002; construction costs were about $12.4 million. Production was expected to be about 1,900 kilograms (reported as 60,000 ounces) per year of gold with costs of operations estimated to be $157 per ounce of gold. Sefamo also had a joint-venture agreement with Rio Tinto plc of the United Kingdom to explore the Mont Kakoulima property; initial studies indicated the presence of a 1-meter (m)-thick horizontal layer of massive sulfides that contain cobalt, copper, nickel, palladium, and platinum (Semafo, Inc., undated§).

In 2001, Société Ashanti de Guinée [owned by Ashanti Goldfields Co. Ltd. of Ghana (85%) and the Guinean Government (15%)] reported a 7% decrease in gold production to 8,808 kg (reported as 283,199 ounces) at its Siguiri mine, which was the largest gold mine in Guinea. Ashanti noted that the decrease was attributed to a reduction in the amount of ore mined as well as a lower than expected metallurgical recovery from their stacked material during the year (Ashanti Goldfields, 2002§).

Société Minière de Dinguiraye [owned by Kenor ASA of Norway (85%) and the Guinean Government (15%)] reported a 20% increase in production of gold to 3,279 kg at the Léro-Karta gold mine in 2001 (Kenor ASA, 2002§). During the year, Kenor was seeking partners to cofinance a $9 million drilling project, which it hoped would more than double its gold resources (Kenor ASA, 2001§).

Diamond production in 2001 was an estimated 370,000 carats, which was down slightly from the average of about 381,000 carats recorded from 1998 to 2000. The Guinean Government noted that the majority of production was from small- scale operators (Africa Energy and Mining, 2000b). Trivalence Mining Corp. of Canada was the largest producer with diamond production of about 40,000 carats at its 85%-owned Aredor diamond concession; the Guinean Government owned the remaining 15%. Trivalence estimated that with indicated resources of 461,282 carats, its production from Aredor at the current level could continue for an additional 10 years (Trivalence Mining Corp., undated§). In December 2000, a letter of intent was signed between Trivalence and Rio Tinto Mining and Exploration of the United Kingdom that granted Rio Tinto the option to earn an interest of up to 58% of the Aredor concession if Rio Tinto made a $6 million exploration expenditure during the next 3 years (40%), conducted a feasibility study within 2 years (13%), and arranged additional debt financing (5%) (Trivalence Mining Corp., 2000). Other companies with diamond interests in Guinea were Dia Bras Exploration, Inc., of Canada, Pinnacle Resource, Inc., of the United States, Searchgold Resources, Inc., of Canada, and Société Alpha Plus of Guinea.

In March, the African Development Bank Group approved a $1.21 million grant to finance a study on how to improve the road that connects the cities of Boke, Guinea, and Quebo, Guinea-Bissau. Work was expected to be accomplished as part of the study included an economic and feasibility analysis, a socio-economic analysis, an environmental impact assessment, an engineering analysis, and a preparation of tender documents (African Development Bank Group, 2001b§). Generally speaking, major highways in Guinea have been paved, but the rural transportation infrastructure was inadequate to meet needs. Guinea had two main ports—Conakry and Kamsar. Conakry, which was the country's main general cargo port, was linked to the Kinda Bauxite Mine by a 104-km 1.435-m standard-gauge railroad line and to the Fria Bauxite Mine by a 145-km 1-m narrow-gauge railway. Kamsar, which handled only bauxite shipments, was linked to the Sangarédi Mine by a 135-km standard-gauge railroad line. In addition to the mine railroads, a 661-km 1-m narrow-gauge line connected Conakry with Kankan.

Although the 1995 mining code significantly improved the business climate for the mineral industry, mining operations remained hampered by infrastructural constraints. International funding of mineral deposit development was proceeding more slowly than anticipated. The less-than-expected foreign

Digitized by Google

investment was attributed to the country's perceived political and economic risks and decreased availability of financing for junior mining companies, as well as civil disturbances in the adjacent countries of Guinea-Bissau, Senegal, and Sierra Leone.

Alumina, bauxite, and gold production are expected to continue to dominate Guinea's economic activity. Ventures that require significant electric power availability, such as an aluminum smelter, could become feasible as the nation's power-generation capacity is increased by the state-owned Société National d'Electricité. The potential of electricity that could be generated by rivers is high; the newly built Garafiri hydroelectric facility features a 75-megawatt powerplant on the Kondoure River.

LIBERIA

In 2001, mineral production in Liberia consisted mainly of artisanal recovery of diamond and gold. Liberia had a GDP of $3.35 billion based on 2000 purchasing power parity data; its population in 2001 was estimated to be about 3.2 million (U.S. Central Intelligence Agency, 2001§). Eastern Liberia is made up of rocks of Birimian age with significant potential for gold. Western Liberia is made up of rocks of Archean age that contain diamond, gold, iron ore, nickel, manganese, palladium, platinum, and uranium (Mines98, 1998b§).

In recent years, the Ministry of Lands, Mines, and Energy has been responsible for the administration of the mining sector; in early 2001, however, the Liberian President pressed the National Legislature of Liberia to grant him control over the country's mineral resources via the Strategic Commodities Act (Allafrica.com, 2001§). A new Mineral Development Policy and Mining Code that outlined five types of mining licenses—reconnaissance licenses are valid for 6 months, with an option to renew; exploration licenses are valid for 3 years, with an option to renew for a further 2 years; Class A licenses cover small-scale alluvial operations and are available for Liberians only; Class B licenses are valid for 5 years over an area of 100 acres; and Class C licenses are valid for 25 years, can be extended for an additional 25 years, and must have a feasibility report submitted for each license—was passed by the Ministry (Resource Information Unit, 2002, p. 152-153).

In June, Mano River Resources, Inc., announced the discovery of its sixth kimberlite pipe in western Liberia since beginning its exploration program in 2000. The company believed that the artisanal diamond workings in the area, which have yielded a number of high-quality diamonds, were located on top of their newly discovered kimberlite (Mano River Resources, Inc., 2001). Also in 2000, a United Nations (U.N.) panel called for an embargo on all diamond exports from Liberia owing to concerns of its potential involvement in civil unrest in Sierra Leone, its neighbor to the northwest. This action by the United Nations followed previous bans on diamond exports from Angola and Sierra Leone (Associated Press, 2000§).

Mano River Resources, Inc., continued exploration at its Gondoja, King George-Larjor, and Weaju properties after having made several gold discoveries on them in 2000. Resources at Weaju were estimated to be about 660,000 metric tons at a grade of 10.9 grams per metric ton (g/t) gold (233,000 ounces of contained gold), and those at King George-Larjor were estimated to be 4.1 Mt at a grade of 4.6 g/t gold (610,000 ounces of contained gold) (Mano River Resources, Inc., 2000a, b). Other companies with gold interests in Liberia in 2001 were AmLib United Minerals of Liberia, Freedom Gold Ltd. of the United States, and Haddington International Resources Ltd. of Australia.

Fusion Oil & Gas plc of Australia and Daytona Energy Corp. of Australia performed a seismic survey on block A, offshore Liberia. The Liberian Government withheld granting oil exploration permits to the companies until the results of the survey were finalized. Although the region of offshore Liberia has not undergone significant exploration in the past, company officials noted that significant risks were involved. Still, they were initially optimistic that the results of the survey would prove positive (Africa Energy Intelligence, 2001b).

SIERRA LEONE

Mineral production in Sierra Leone in 2001 consisted mainly of artisanal recovery of diamond and gold. Sierra Leone had a GDP of $2.20 billion based on 2001 purchasing power parity data (International Monetary Fund, 2002§); in 2000, Sierra Leone's population was estimated to be about 5 million (World Bank, 2001c§). Civil strife has adversely affected investment in natural resource development since 1995, although conditions would improve with the declaration that war had ended in September 2001.

The Ministry of Mineral Resources is responsible for the administration of the mining sector. In 1999, the Sierra Leonean Parliament enacted an amendment to the 1994 Mines and Minerals Act that introduced three new sections. These are a procedure for sale and export of precious minerals by licence holders, penalties for unlawful possession of precious minerals, and penalties for smuggling precious minerals from Sierra Leone (Mining Journal, 2000).

In December 2001, Sierra Rutile Ltd. of Sierra Leone [(jointly owned by MIL Investments SA of Luxembourg (75%) and U.S. Titanium (25%)] announced rutile production at the Sierra Rutile mine would resume production in 2003. The company was expected to receive a $15 million grant from the International Finance Corporation in 2002 (Africa Mining Intelligence, 2001b). In 2000, Sierra Leone's President announced that he hoped that Sierra Rutile, which had operated the largest and highest grade resource of rutile in the world prior to its closing in 1995, would be producing sometime in 2002. Furthermore, he pledged to assist in any financing needed to restart operations. Nord Resources Corp. of the United States, which sold its 50% share in Sierra Rutile in 1999, had expected that capital expenditures of more than $100 million would be needed to restart operations (Industrial Minerals, 2001).

In early 2001, Sierra Leone and Angola introduced a diamond certification scheme in response to U.N. sanctions that are aimed at the prohibition of importation of diamonds coming from rebel-controlled areas in their countries. The announcement came after an international meeting on "conflict diamonds" in Namibia and the establishment of a task force

Digitized by Google

comprised of diamond producing, exporting, and manufacturing countries within the Southern African Development Community, the World Diamond Council, and the European Union (South African Broadcasting Corp., 2001§). The main diamond deposits in Sierra Leone are the Koidu and Tongo Fields. In 2001, DiamondWorks Ltd. of Canada, which owned 60% of the Koidu mine, announced that it was returning to Sierra Leone. In early 2002, the company began to undergo an assessment of the status of the mine. The mine has reserves of 2.67 million carats. DiamondWorks also holds two separate diamond exploration licenses on the Sewa River, which host reserves estimated to contain 1.7 million carats. Rex Diamond Corp. had mining licenses at the Tongo Fields and Zimmi deposits (Africa Mining Intelligence, 2002; Mbendi Information Services (Pty) Ltd., 2001§).

After initial oil surveys in 2001 by TGS Nopec, Inc., of the United States indicated the potential for oil in the offshore Sierra Leonean regions of Bonthe and Pujehun, the Government announced that it would draft a decree that outlines the legal conditions for exploring for oil in these offshore concessions and plan for a bidding round. The first exploration wells could be drilled as early as 2003 with production as early as 2005 (Africa Energy Intelligence, 2001c).

In April 2001, the African Development Bank Group (ADBG) approved a $12.92 million loan to assist in the economic recovery of Sierra Leone. The loan is part of the ADBG's role in the National Rehabilitation and Recovery Program (NRRP) of Sierra Leone, which is a partnership among the ADBG, the International Monetary Fund, the Government of Sierra Leone, and the World Bank. The NRRP focuses on several goals, which include the restoration of peace and the stabilization of the economy (African Development Bank Group, 2001a§).

References Cited

Africa Energy and Mining, 1999, Côte d'Ivoire—Apache ducks out but stays: Africa Energy and Mining, no. 259, September 15, p. 3.

Africa Energy and Mining, 2000a, Côte d'Ivoire—SIR privatization shelved: Africa Energy and Mining, no. 267, January 12, p. 2.

Africa Energy and Mining, 2000b, Guinea bauxite, diamond, and gold forecast: Africa Energy and Mining, no. 271, March 15, p. 8.

Africa Energy Intelligence, 2001a, Ivory Coast—Early 2002 start-up date for Espoir: Africa Energy Intelligence, no. 298, May 9, p. 5.

Africa Energy Intelligence, 2001b, Liberia—Work stalled on block A: Africa Energy Intelligence, no. 290, January 10, p. 4-5.

Africa Energy Intelligence, 2001c, Sierra Leone—Oil legislation in works?: Africa Energy Intelligence, no. 300, June 6, p. 7.

Africa Energy Intelligence, 2002, Ivory Coast—Ten years of self-sufficiency: Africa Energy Intelligence, no. 315, January 30, p. 3-4.

Africa Mining Intelligence, 2001a, Guinea—France subsidizes mining research: Africa Mining Intelligence, no. 16, June 13, p. 2.

Africa Mining Intelligence, 2001b, Sierra Leone—Sierra Rutile set to re-open: Africa Mining Intelligence, no. 28, December 19, p. 2.

Africa Mining Intelligence, 2002, Sierra Leone—DiamondWorks makes headway at Koidu: Africa Mining Intelligence, no. 31, February 6, p. 3.

African Mining Bulletin, 2001, Ivory Coast—Etruscan acquires gold permits: African Mining Bulletin, no. 144, June 5, p. 3.

Industrial Minerals, 2001, Sierra Rutile restart: Industrial Minerals, no. 404, May, p. 65.

Mano River Resources, Inc., 2000a, Drilling at Mano's King George Larjor project increases gold resource, 2000: Vancouver, British Columbia, Canada, Mano River Resources, Inc., press release, December 12, p. 1.

Mano River Resources, Inc., 2000b, Geological resource of 768,000 contained ounces of gold independently estimated at Mano's King George Larjor and Weaju properties, at an average grade of 6.9 grams per tonne: Vancouver, British Columbia, Canada, Mano River Resources, Inc., press release, July 11, p. 1.

Mano River Resources, Inc., 2001, Mano discovers a sixth kimberlite and makes macrodiamond finds in its KPO range licence in western Liberia: Vancouver, British Columbia, Canada, Mano River Resources, Inc., press release, June 13, p. 1.

Metal Bulletin, 2001a, Guinea alumina refinery raises production by more than 150,000 tpy: Metal Bulletin, no. 8583, June 14, p. 4.

Metal Bulletin, 2001b, Normandy Mining sells African assets: Metal Bulletin, no. 8636, December 24, p. 7.

Mining Journal, 2000, Sierra Leone, *in* Mining annual review 2000: Mining Journal Ltd. CD-ROM.

Mining Journal, 2001a, Côte d'Ivoire, *in* Mining annual review 2000: Mining Journal Ltd. CD-ROM.

Mining Journal, 2001b, Ivory Coast hopes to regain position ... diamonds among early targets: Mining Journal, v. 337, no. 8646, August 10, p. 91.

Oil & Gas Journal, 2001, [untitled]: Oil & Gas Journal, v. 99, no. 52, p. 127.

Plunkert, P.A., 2002a, Bauxite and alumina: U.S. Geological Survey Mineral Commodity Summaries 2002, p. 30-31.

Plunkert, P.A., 2002b, U.S. trade in bauxite and alumina in the fourth quarter 2001: U.S. Geological Survey Mineral Industry Surveys, March, 4 p.

Resource Information Unit, 2002, Register of African mining 2001/2002: Subiaco, Australia, Resource Information Unit, 350 p.

Trivalence Mining Corp., 2000, Letter of intent with Rio Tinto for option and joint venture of Aredor kimberlites: Vancouver, British Columbia, Canada, Trivalence Mining Corp. press release, December 18, p. 1.

Internet References Cited

African Development Bank Group, 2001a (April 4), The African Development Fund approves a $12.92 million loan to assist in reviving the economy of Sierra Leone, accessed May 22, 2002, at URL http://www.afdb.org/knowledge/loans2001/adf_econimy_Sierra_Leone.htm.

African Development Bank Group, 2001b (March 1), The African Development Fund approves a $1.21 million grant to finance the Boke-Quebo multinational road study (Guinea/Guinea-Bissau), accessed May 10, 2002, at URL http://www.afdb.org/knowledge/loans2001/BokeQuebo_Guinea.htm.

Alexander's Gas & Oil Connections, 1999 (September 14), Ivory Coast extends preliminary round of bids for stake in SIR refinery, accessed September 16, 2000, at URL http://www.gasandoil.com/goc/history/welcome.html.

Allafrica.com, 2001 (January 18), Taylor moves to own minerals, accessed May 10, 2002, at URL http://allafrica.com/stories/200101180333.html.

Ashanti Goldfields Co. Ltd., 2002 (January 28), Production results—2001 was a year of strong operating performance for Ashanti, Press Release, accessed May 7, 2002, at URL http://www.ashantigold.com/ashantigold/ir/viewpress.jsp?ref=6.

Associated Press, 2000 (December 19), Embargo on Liberian diamonds pursued, accessed December 30, 2000, via URL http://dailynews.yahoo.com.

Boubah.com news service, 2000 (December), Interview with GAPCO's director on new Guinea project, accessed August 3, 2001, at URL http://www.boubah.com/Guineenews/Interview/Interview.htm.

COGEMA Group, 2000 (August 9), COGEMA buys COMINOR, accessed April 11, 2001, at URL http://www.cogema.fr/actualites_gb/communiques/presse_gb/august092000.html.

Consolidated Trillion Resources, 2000 (October 11), [untitled], Press Release, accessed April 16, 2002, at URL http://www.trillionresources.com/news001011.pdf.

Guardian Online, 2001 (November 6), Nigeria, six others form free trade zone, accessed April 12, 2002, at URL http://www.ngrguardiannews.com/news2/nn838705.html.

International Monetary Fund, 2002 (April), World economic outlook database, accessed June 12, 2002, at URL http://www.imf.org/external/pubs/ft/weo/2002/01/data.

Kenor ASA, 2001 (November 22), Kenor—Third quarter—2001, Press Release, accessed May 7, 2002, at URL http://cws.huginonline.com/K/71/PR/200111/841310_5.html.

Kenor ASA, 2002 (April 1), Annual production figures 2001, Press Release, accessed May 7, 2002, at URL http://cws.huginonline.com/K/71/PR/200201/844592_5.html.

Digitized by Google

MBendi Information Services (Pty.) Ltd., 2001 (October 30), Sierra Leone—Diamond mining, accessed February 25, 2002, at URL http://www.mbendi.co.za/indy/ming/dmnd/af/sl/p0005.htm.
MBendi Information Services (Pty.) Ltd., 2000a (July 12), Côte d'Ivoire—Iron ore mining, accessed February 22, 2002, at URL http://www.mbendi.co.za/indy/ming/iron/af/ci/p0005.htm.
MBendi Information Services (Pty.) Ltd., 2000b (July 12), Côte d'Ivoire—Nickel and cobalt mining, accessed February 22, 2002, at URL http://www.mbendi.co.za/indy/ming/nkcb/af/ci/p0005.htm.
MBendi Information Services (Pty.) Ltd., 2000c (July 12), Côte d'Ivoire—Oil and gas industry, accessed February 22, 2002, at URL http://www.mbendi.co.za/indy/oilg/gas_/af/ci/p0005.htm.
Metals-Russia.com, 2001 (April 17), Rusal to manage production facilities of Guinea bauxite company SBK, accessed May 6, 2002, at URL http://www.metals-russia.com/news/2001/April/17.04.01/5.shtml.
Mines98, 1998a, Ivory Coast country profile, accessed November 8, 2001, at URL http://www.mines98.com/country/ci/3.htm.
Mines98, 1998b, Liberia country profile, accessed November 8, 2001, at URL http://www.mines98.com/country/lr/3.htm.
Mining-Technology.com, [undated], CBG, Guinea bauxite (aluminum ore) mining operations, accessed April 18, 2002, at URL http://www.mining-technology.com/projects/cbg.
Semafo, Inc., [undated], Guinea operations, accessed May 6, 2002, at URL http://www.semafo.com/operations_guinea.html.
South African Broadcasting Corp., 2001 (February 19), Angola and Sierra Leone introduce diamond certification scheme, accessed May 22, 2002, at URL http://www.sabc.co.za/units/chanafr/news/010219.html.
Trivalence Mining Corp., [undated], Overview of operations at Aredor diamond mine in Republic of Guinea, accessed May 8, 2002, at URL http://www.trivalence.com/guinea_operations.htm.
U.S. Central Intelligence Agency, 2001, Liberia, World Factbook 2001, accessed February 25, 2002, at URL http://www.odci.gov/cia/publications/factbook/geos/li.html.
World Bank, 2001a (September 18), Côte d'Ivoire at a glance—2000, accessed February 22, 2002, at URL http://www.worldbank.org/data/countrydata/countrydata.html#AAG.
World Bank, 2001b (September 21), Guinea at a glance—2000, accessed February 22, 2002, at URL http://www.worldbank.org/data/countrydata/countrydata.html#AAG.
World Bank, 2001c (October 10), Sierra Leone at a glance—2000, accessed February 22, 2002, at URL http://www.worldbank.org/data/countrydata/countrydata.html#AAG.

Major Sources of Information

Centre de Promotion et de Developpement Minières
P.O. Box 295
Conakry, Republic of Guinea
Telephone: (224) 41-15-44
Fax: (224) 41-49-13

Ministère des Ressources Minières et Pétrolières
B.P. V 50
Abidjan, Côte d'Ivoire
Telephone: (225) 21-66-17
Fax: (225) 21-53-20

Ministère des Mines, de la Géology et de l'Environnment
P.O. Box 295
Conarky, Republic of Guinea
Telephone: (224) 45-45-26
Fax: (224) 41-49-13

Ministry of Lands, Mines, and Energy
P.O. Box 10-9024
Capital Hill
1000 Monrovia 10, Liberia
Telephone: (231) 221-580

Ministry of Mineral Resources
Youyi Bldg., Brookfields,
Freetown, Sierra Leone
Telephone: (232) 22-240-420
Fax: (232) 22-240-574

Société pour le Développement Minier (SODEMI)
01 BP 2816
Abidjan, Côte d'Ivoire
Telephone: (225) 44-29-94
Fax: (225) 44-08-21

Digitized by Google

TABLE 1
CÔTE D'IVOIRE, GUINEA, LIBERIA, AND SIERRA LEONE: ESTIMATED PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Thousand metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000	2001
CÔTE D'IVOIRE 3/						
Cement		1,100	650	650	650	650
Columbite	kilograms	NA	NA	273 4/	137 4/	130
Diamond	carats	306,665 4/	310,000	398,282 4/	320,207 4/	320,000
Gold	kilograms	2,419 4/	3,400	2,717 4/	3,154 4/	3,100
Gravel and crushed rock		NA	NA	570 4/	540 4/	550
Natural gas	million cubic meters	879	1,000	1,395 r/ 4/	1,323 r/ 4/	1,230
Petroleum:						
Crude	thousand 42-gallon barrels	5,334 4/	7,300	10,000	11,700 r/	12,000
Refinery products	do.	7,850 4/	7,500	10,000	11,700 r/	12,000
Sand		NA	NA	230	740	750
Tantalite	kilograms	1,350 4/	1,400	686 4/	408 4/	400
GUINEA 5/						
Alumina:						
Production:						
Hydrate		527	490	500	550	550
Calcined		650 4/	500 r/ 4/	568 r/ 4/	541 r/ 4/	550
Shipments, calcined		640	511 4/	480 4/	480	500
Bauxite:						
Mine production:						
Wet basis 6/		19,300 r/	17,300 r/ 4/	17,320 r/ 4/	17,950 r/ 4/	17,950 4/
Dry basis 7/		16,359 4/	15,570 r/ 4/	15,590 r/ 4/	15,700 r/ 4/	15,700
Calcined		660	100	100	100	100
Shipments (dry basis):						
Metallurgical		14,500	14,000	14,000	14,000	14,000
Calcined		95	100	100	100	100
Cement		260 r/	277 r/ 4/	297 r/ 4/	300 r/ 4/	300 4/
Diamond 8/ 9/	thousand carats	205	392 r/ 4/	383 r/ 4/	369 r/ 4/	370
Gold 9/	kilograms	7,100	7,835 r/ 4/	12,001 r/ 4/	13,104 r/ 4/	13,000
Salt		NA	NA	15	15	15
LIBERIA 10/						
Cement, hydraulic 11/		7	10	15	15	15
Diamond	carats	200,000	300,000	200,000	170,000	170,000
Gold	kilograms	500	800	1,000	1,000	1,000
SIERRA LEONE						
Cement 12/		50	100	100	100	100
Diamond	thousand carats	400	250	600	600 r/	600
Gold	kilograms	20	15	30	30	30
Gypsum		2	4	4	4	4
Salt		10	1	1	1	1

r/ Revised. NA Not available.

1/ Table includes data available through May 22, 2002.

2/ Estimated data are rounded to no more than three significant digits.

3/ In addition to the commodities listed, Côte d'Ivoire produced clays, crushed granite, manganese, sand and gravel, and stone, but information is inadequate to make estimates of output levels.

4/ Reported figure.

5/ In addition to the commodities listed, Guinea produced modest quantities of crude construction materials (clays, sand and gravel, and stone), but information is inadequate to make reliable estimates of output levels.

6/ Metallurgical plus calcinable ore estimated to be 13% water.

7/ Data are for wet-basis ore estimated to be 13% water, reduced to dry basis estimated to be 3% water.

8/ Production is approximately 70% to 80% gem quality.

9/ Figures include artisanal production.

10/ In addition to the commodities listed, Liberia produced a variety of industrial minerals and construction materials (clays, gypsum, sand and gravel, and stone) but information is inadequate to make reliable estimates of output levels.

11/ Cement production from the Liberian Cement Corporation had been reported as zero in 1997 because of the civil war. The Scancem AB 1997 annual report indicates the cement plant was open during most of the civil war.

12/ Production from imported cement clinker.

Digitized by Google

Digitized by Google

THE MINERAL INDUSTRIES OF

DJIBOUTI, ERITREA, ETHIOPIA, AND SOMALIA

By Thomas R. Yager

DJIBOUTI

In recent years, Djibouti, which is a small East African country, has been known to produce occasionally small quantities of clays, granite, limestone, marble, salt, and sand and gravel. Other mineral occurrences of potential economic interest included diatomite, geothermal fluids and mineral salts, gold, gypsum, perlite, petroleum, and pumice.

In 2001, Djibouti's gross domestic product (GDP) amounted to about $1.73 billion at purchasing power parity. The per capita GDP at purchasing power parity was about $700 in 2000. Djibouti's GDP increased by 2% in 2001 after rising by 0.7% in 2000, 2.2% in 1999, and 0.1% in 1998. In 2000, manufacturing accounted for 7% of the GDP; construction, 8%; electricity, 5%; and mining and energy, about 1% (International Monetary Fund, 2002b, p. 164; 2002a§[1], b§).

By the end of 2002, the Government hoped to establish a fiscal, institutional, and legal framework to support the development of domestic natural resources. The Government also planned to promote the use of local materials in construction and public works (World Bank, 2001b, p. 30).

In 2000, Djibouti's production of salt increased to 135,933 metric tons (t) from 127,283 t in 1999 and 82,876 t in 1998 (British Geological Survey, 2002, p. 227). Salt was produced by artisanal miners and exported to Ethiopia.

The International Cement Review (2001a) estimated that Djibouti's cement consumption increased to 80,000 t in 2001 from 70,000 t in 2000 and 1999 and 60,000 t in 1998. The country had no domestic cement production; most imports came from countries in the Persian Gulf. Djibouti also served as a transshipment center for cement destined for Ethiopia.

Djibouti did not have production facilities for petroleum products; all petroleum demand was met through imports. In 2001, the Iranian Government signed agreements with Etablissement de Hydrocarbures and Electricité de Djibouti to build an oil refinery and a power station (Africa Energy Intelligence, 2001a). Djibouti also had resources of natural gas.

In 2000, Djibouti produced 223.3 gigawatthours (GWh) from four diesel-fired powerplants. This was an increase from 194.3 GWh in 1999 and a decrease from 225.6 GWh in 1995. In 2001, the Government began discussion of a joint venture between Geothermal Development Associates of Nevada and Electricité de Djibouti to create a 30-megawatt (MW) geothermal plant near Assal. The Government was working on a long-term plan for development of the electrical sector that it hoped to complete by March 2002; power generation was to be deregulated (Africa Energy Intelligence, 2001b; World Bank, 2001b, p. 30; Ministère de l'Economie des Finances et de la Planification, Chargé de la Privatisation, 2001§).

Djibouti's transportation network comprised about 2,900 kilometers (km) of roads, of which nearly 400 km was paved. The World Bank assisted the Government in developing a long-term program to develop the national road network. Initial investment would focus upon road links to Ethiopia to complement the planned increase in capacity at the Port of Djibouti (World Bank, 2001b, p. 30).

The outlook for Djibouti's mineral industry is for little growth in the short run; constraints include small domestic markets, minimal known natural resources, and slow GDP growth. The World Bank (2001b, p. 35) predicted that the GDP would increase by 1.6% in 2002, 2.1% in 2003, and 3.1% in 2004.

ERITREA

In recent years, the East African country of Eritrea has produced a variety of minerals, rocks, and semimanufactured goods, which included basalt, cement, common clay, kaolin, coral, gold, granite, gravel, gypsum, lime, limestone, marble, pumice, quartz, salt, sand, and silica sand (table 1). The country also had known occurrences of such metals as chromium, copper, iron, lead, magnesium, nickel, silver, and zinc and such industrial minerals as barite, feldspar, and potash.

In 2001, Eritrea's GDP increased by 6.5% after falling by 8.6% in 2000 and rising by 1.2% in 1999 and 3.2% in 1998. In 1999, manufacturing accounted for 8% of the GDP; construction, 9%; and mining and quarrying, less than 1% (International Monetary Fund, 2000, p. 24; 2002b, p. 164).

Gold was produced in Eritrea by artisanal miners. From 1997 to 2000, the production of gold declined by nearly 57% (table 1); this decrease may be attributable to the fall in gold prices and the war with Ethiopia. In 2000, the value of gold produced in Eritrea amounted to $1.7 million (Zerefe Awalom, Eritrea Ministry of Energy and Mines, written commun., 2001).

Sub-Sahara Resources NL (formed by the merger of Maiden Gold NL and Universal Gold NL) held the exploration licenses for the Debarwa copper deposit and the Emba Derho polymetallic deposit. In 2001, Sub-Sahara engaged in

[1]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

exploration at the abandoned gold mines at Medrizien and Woki Duba. The company also explored for copper at Aggiar and Medrizien and for zinc near Adi Nefas; Sub-Sahara applied for a license that contains the Adi Nefas gold and zinc deposits. In 2002, the company planned to continue exploration activities (Sub-Sahara Resources NL, 2002, p. 11-12).

In early 2001, Nevsun Resources Ltd. completed geologic mapping and rock sampling on the Enjahai, Seroa Mine, and Tofalebu gold occurrences. Nevsun planned to engage in diamond drilling at Enjahai. Other gold occurrences that have been explored in recent years include Ak, Bisha, Harab Suit, Ketina, Matite, Nefasit, Okreb, Tekeze, and Zara (Resource Information Unit, 2001a, p. 91-94).

The Eritrea Cement Factory, which was the country's only cement producer, was able to increase output in 1999 owing to upgrades of equipment and employee skills. The war with Ethiopia caused the production of many construction materials to decline in 1999 and 2000 (table 1). In 2000, the value of gravel and crushed rock amounted to $418,000; basalt, granite, limestone, marble, and silica sand, $399,000; and sand, $367,000 (Zerefe Awalom, Eritrea Ministry of Energy and Mines, written commun., 2001).

In 2001, postwar rebuilding efforts spurred a recovery in Eritrea's construction sector. Numerous projects, which included repairs to the country's airports, bridges, dams, railways, and roads; expansion and improvements to ports and water and sewage networks; and the construction of housing units and commercial and industrial buildings, were underway or under active consideration. The World Bank and the Eritrean Government developed a $280 million plan to rebuild Eritrea's economy.

Salt producers in Eritrea included Alkelder Salt & Affiliates, Assab Salt Works, and Massawa Salt Works. The country's salt production declined sharply in 1998 and 1999 (table 1). The Government planned to privatize Assab Salt Works and Massawa Salt Works. In 2000, the value of salt produced in Eritrea amounted to $909,000 (Zerefe Awalom, Eritrea Ministry of Energy and Mines, written commun., 2001).

In 2000, Eritrea's consumption of petroleum products was estimated to be about 2.9 million barrels (Mbbl), all of which has been imported since the closure of the Assab Refinery in 1997. In May 2001, CMS Oil and Gas (a subsidiary of CMS Energy Corporation) signed an agreement with the Government to explore for natural gas and petroleum in the Dismin Block in northeastern Eritrea. The Government was also interested in developing geothermal, solar, and wind energy; geothermal areas occur in the Danakil region (U.S. Commercial Service, 2001§; U.S. Energy Information Administration, 2002§).

The Eritrean Electricity Authority, which was responsible for the generation, transmission, and distribution of electricity, had about 60 MW of diesel-fired capacity. In 1999, Eritrea produced an estimated 206.8 GWh of electricity, which was an increase from 185.8 GWh in 1998 and 154.8 GWh in 1996. Sales of electricity increased to 155.9 GWh in 1999 from 145.6 GWh in 1998 and 127.5 GWh in 1996. Many rural health clinics, schools, and villages used solar photovoltaic power systems (International Monetary Fund, 2000, p. 34; U.S. Energy Information Administration, 2002§).

Eritrea's transportation network comprised about 4,000 km of roads, of which nearly 900 km was paved. The railway linking Ak'ordat and Asmara with the port of Massawa was 317 km; only a 5-km stretch in Massawa was operational, but rehabilitation of the remainder was under way. Ports and harbors were Assab and Massawa.

The outlook for Eritrea's mineral industry is for gradual recovery from the war. Demand for such construction materials as basalt, granite, gravel, limestone, marble, and sand is likely to increase. Further development depends upon favorable global market conditions, the continuation of peace with Ethiopia, and landmine clearing.

ETHIOPIA

Ethiopia produced minerals, rocks, and semimanufactured goods, such as brick clay, cement, columbium (niobium), diatomite, feldspar, gold, gypsum and anhydrite, kaolin, lime, pumice, salt, scoria, soda ash, sand, stone, and tantalum (table 1). Ethiopia's main mineral export was gold. Other metal deposits included copper, iron ore, manganese, molybdenum, nickel, platinum, and zinc. Other industrial mineral occurrences included apatite, bentonite, dolomite, gemstones, granite, potash, quartz, and talc.

In 2001, Ethiopia's GDP amounted to about $39 billion at purchasing power parity. Per capita GDP at purchasing power parity was $590 in 2000. The GDP grew by 7.9% in 2001 after increasing by 5.4% in 2000 and 6.3% in 1999. Mining and quarrying accounted for less than 1% of the GDP (International Monetary Fund, 2002b, p. 164; 2002a§, b§).

The Ethiopian Mineral Resources Development Enterprise (EMRDE) operated the Kenticha columbium and tantalum mine near Borena. In fiscal year 2000-01, EMRDE produced 47 t of tantalum and earned export revenues of $5.6 million (table 1). For fiscal year 2001-02, the company planned to increase tantalum production to 60 t.

Midroc Gold (a subsidiary of Midroc Ethiopia Ltd.) operated the Lega Dembi gold mine. The company planned to start underground operations and to make upgrades to its processing plant in 2001 that would increase gold production capacity to nearly 4,700 kilograms per year (kg/yr) of gold from about 2,800 kg/yr. Other gold mines that were operating in Ethiopia included the Adola and the Sakaro. Sheba Exploration Ltd. of the United Kingdom was prospecting for gold in the northern province of Tigray. In 2000, gold was the mineral commodity that made the largest contribution to the Ethiopian economy; the value of gold produced exceeded $33.18 million (Gebre-Selassie, 2001; Resource Information Unit, 2001b; Getachew Tesfaye, Ethiopia Ministry of Mines and Energy, written commun., 2001).

In 2001, Golden Prospect Plc of the United Kingdom was granted a 3-year exploration license for platinum at Daleti and Tulu Dimtu. The company was also granted a prospecting license for Yubdo, which had produced 2,700 kg of platinum in the past. Mineral analysis indicated that gold, palladium, and rhodium also occurred at Yubdo. Golden Prospect began

Digitized by Google

negotiations with potential joint-venture partners for further exploration work (Resource Information Unit, 2001b).

Abay Natural Resources Development Plc produced fire opal in North Shewa; five other companies were engaged in exploration and mining. Sales of fire opal were concentrated in Asia, especially in Japan. Abay sold its products at the Hong Kong Jewellery and Watch Fair and planned to market some of its product through such international auction houses as Christie's and Sotheby's. Cutting and polishing was done in Hong Kong and India; the company planned to develop a cutting industry in Ethiopia that used domestic labor. Other semiprecious and ornamental stones produced in Ethiopia included amethyst, peridot, and rose quartz. Ethiopia also has deposits of agate, aquamarine, chalcedony, chrysoprase, emerald, garnet, jasper, obsidian, ruby, sapphire, and spinel (Henricus, 2002).

Salt producers in Ethiopia included Afdera Salt Works Association, Duck Table Salt Processore Plc, and Palm & Salt Association. In 2000, the value of salt produced in Ethiopia amounted to about $6.84 million (Getachew Tesfaye, Ethiopia Ministry of Mines and Energy, written commun., 2001).

From 1995 to 2000, Ethiopia's consumption of diammonium phosphate (DAP) fell to 191,493 t from 202,312 t. During the same period, the consumption of urea increased to 98,524 t from 44,411 t. Ethiopia's consumption of DAP was expected to increase to 240,000 t in 2001 and 320,000 t in 2002. Urea consumption was expected to increase to 128,000 t in 2001 and 168,000 t in 2002. All Ethiopia's nitrogen and phosphate fertilizers were imported. In recent years, the Geological Survey of Ethiopia has explored for phosphate rock in the western part of the country (Gebre-Selassie, 2000; World Bank, 2001a, p. 3).

In March, Sicor Inc. of the United States signed agreements to develop the Gazoil Ethiopia project at a cost of $1.4 billion. Sicor planned to build a natural-gas-to-liquids plant for the production of about 183,000 t/yr of ammonia. The ammonia would be used in the domestic production of urea. The Gazoil project would also generate electricity and produce diesel, gasoline, jet fuels, and kerosene (Weeden, 2001).

At the end of 2001, Ethiopia was totally dependent on imports to meet its demand for petroleum. In fiscal year 2000-01, Ethiopia imported 8.33 Mbbl of petroleum products, which was an increase from 7.81 Mbbl in fiscal year 1999-2000 and 7.73 Mbbl in fiscal year 1998-99. Automotive diesel oil accounted for 56% of petroleum imports in fiscal year 2000-01; jet fuel, 21%; gasoline, 13%; and residual fuel oil, 10% (National Bank of Ethiopia, 2001§). The International Monetary Fund (2002a, p. 32) predicted that the value of fuel imports would fall to $236 million in fiscal year 2002-03 from $292 million in fiscal year 2000-01 and would then increase to $278 million by fiscal year 2005-06.

In 2001, Ethiopia signed an agreement with the Governments of Djibouti and Sudan in which Ethiopian Electric Power Company (EEPCO) would export electricity to Djibouti and Sudan. Sudan agreed to supply Ethiopia with benzene and petroleum products (Africa Energy Intelligence, 2001d).

In fiscal year 2000-01, Ethiopia produced 1,811.7 GWh of electricity, which was an increase from 1,688.8 GWh in fiscal year 1999-2000 and 1,652.9 GWh in fiscal year 1998-99. Hydroelectric sources accounted for 98.8% of power generated; thermal sources, 0.9%; and geothermal sources, 0.3%. At the beginning of 2000, Ethiopia's hydroelectric capacity was 377.8 MW; thermal, 40.3 MW; and geothermal 7.3 MW (Teklemariam and others, 2000; National Bank of Ethiopia, 2001§).

Ethiopia's exploitable hydroelectric energy potential could be 162,000 MW. In 2001, Enerco of Italy signed a memorandum of understanding with EEPCO to build three new hydroelectric plants at a cost of $350 million to $410 million. The Genale plant was expected to have a capacity of 162 MW; the Bilbi Moya, 75 MW; and the Awash IV, 40 MW. Bilbi was expected to be operational by the end of 2003, and Awash IV, in 2004. EEPCO awarded a contract to Midroc Ethiopia to build a 150-MW hydroelectric plant on the Gojeb River (Africa Energy Intelligence, 2001c, 2002; World Resources Institute and others, 1996, p. 288).

The geothermal potential of the Ethiopian Rift has been estimated to be 700 MW, which included the Central Afar with 260 MW; the Lakes District, 170 MW; the Denkali Depression, 150 MW; and the Southern Afar, 120 MW. The Aluto-Langano geothermal powerplant in the lakes District had a capacity of 7.3 MW; the Government planned to increase capacity at the plant to 30 MW. Other areas of geothermal exploration include Tendaho, which is located in the Northern Afar (Teklemariam and others, 2000).

At the end of 2000, Ethiopia's transportation network comprised 29,799 km of roads, of which nearly 3,890 km was paved and 25,909 km, gravel. The Ethiopian segment of the Addis Ababa-Djibouti railroad was 681 km. From 1996 to 2000, the Ethiopian Road Construction Authority invested about $700 million and built more than 7,000 km of new roads (Gebre-Selassie, 2001).

The outlook for Ethiopia's mineral industry is favorable. Improvements in the general economic situation and the need to rebuild infrastructure are likely to increase demand for building materials. The International Monetary Fund (2002a, p. 28) predicted that the GDP would increase in fiscal year 2001-02 by 5.8%, and in fiscal years 2002-03 and 2003-04 by 6.0%. Ethiopia's plans to expand infrastructure may increase the economic viability of its metals and industrial minerals deposits. Favorable conditions in the world minerals markets and the continuation of peace with Eritrea are also important.

SOMALIA

Somalia produced small quantities of gypsum, salt, and sepiolite (meerschaum). Recent discoveries and artisanal mining of gemstones included amethyst, aquamarine, emerald, garnet, opal, ruby, and sapphire. The country also had deposits of feldspar, iron ore, kaolin, limestone, natural gas, quartz, silica sand, tantalum, tin, and uranium. The minerals industry made only a small contribution to Somalia's exports and to the economy in general.

Officially reported mineral and trade data have been unavailable owing to lack of a central Government from 1991 to 2000. Somaliland and Puntland (two regions in northern

Digitized by Google

Somalia) have declared independence from Somalia. The new central Government created in 2000 controlled only a small portion of Mogadishu and faced serious challenges from regional warlords (Washington Post, 2001). The civil war has had considerable adverse consequences for the economy, which included the minerals sector. The war forced the closure of Somalia's cement plant and oil refinery and halted exploration for natural gas and other resources.

Emeralds were produced at Alihiley and Simodi in western Somaliland. Aquamarine was known to occur near Darburuq, Gebiley, and Lafrug; garnet, near Alihiley, Boroma, and Darburuq; and sapphire, near Gebiley. Mining of Somaliland's gemstones has been limited by a lack of modern equipment, civil strife, and damage to the infrastructure (Henricus, 2001b).

The European Community-funded nongovernmental organization Progressive Interventions was working with the Government of Somaliland to exploit local gemstone resources. Issues under consideration included investment in exploration in exploration and mining equipment; training of local miners; organizing the miners and dealers into a mining and trade association; marketing the gemstones; and adding value through cutting and polishing (Henricus, 2001a).

Somalia imported all its cement, most of which was believed to be sourced from Kenya, Oman, and Saudi Arabia. The International Cement Review (2001b) estimated that Somalia's cement consumption remained unchanged at 100,000 t in 2001. The Berbera cement plant had a capacity of 300,000 t/yr but needed substantial upgrade work to resume production.

In 2000, Somalia's petroleum consumption was estimated to be nearly 1.5 Mbbl. Since the closure of Somalia's refinery in 1991, which was run by the state-owned Iraqsoma Refinery Corporation, all the country's demand for petroleum products has been met through imports. In 2001, TotalFinaElf signed a 1-year agreement with the Somali Government to explore for oil in the southern region of Lower Shabelle and Juba Valley (Iran Daily, 2001; U.S. Energy Information Administration, 2002§).

In May 2001, the Government of Somaliland signed an agreement with Rovagold Ltd. of the United Kingdom, Continental Petroleum Engineering Company Ltd. of China, and China Petrochemical Corporation to explore for oil. Zarara Energy Ltd. of South Africa also signed an exploration agreement with the Government. Chinese firms have been reported to be involved in oil exploration in Puntland (U.S. Energy Information Administration, 2002§).

Somalia's installed electricity generating capacity amounted to 70 MW, all of which was diesel fired. The country's exploitable hydroelectric energy potential could be 50 MW. Ente Nazionale Energia Elettrica was responsible for the generation, transmission, and distribution of electricity. In October 2001, the Government signed agreements with WorldWater Corp. of the United States to develop such renewable energy sources as solar power. Prior to the civil war, the Government had planned to install wind energy systems in rural areas and turbines to connect to the electricity grid in Mogadishu. The Government of Puntland planned to privatize the electricity sector (World Resources Institute and others, 1996, p. 288; U.S. Energy Information Administration, 2002§). Somalia's transportation network comprised about 22,000 km of roads, of which 2,600 km were paved. Oil pipelines were 15 km. The principal ports and harbors were located at Bender Cassim (Boosaaso), Berbera, Chisimayu (Kismaayo), Merca, and Mogadishu.

The outlook for Somalia's mineral industry is for little change in the short run. The Governments of Puntland and Somaliland have not gained international recognition, and the central Government in Mogadishu faces serious obstacles to unifying the country, much less repairing the damage from the civil war. Other problems include weak infrastructure and a domestic market that is limited by severe poverty. In the long run, an end to the civil war; investment in education, health, and infrastructure; favorable world market conditions; improvements in mining technology; and other conditions amenable to private foreign investment could lead to greater exploitation of Somalia's mineral resources.

References Cited

Africa Energy Intelligence, 2001a, Djibouti—Iran in energy push: Africa Energy Intelligence, no. 299, May 23, p. 2.

Africa Energy Intelligence, 2001b, Djibouti—Talks on geo-thermal project: Africa Energy Intelligence, no. 299, May 23, p. 2.

Africa Energy Intelligence, 2001c, Ethiopia—Three new power stations: Africa Energy Intelligence, no. 302, July 4, p. 6.

Africa Energy Intelligence, 2001d, Ethiopia/Sudan—Oil cooperation pact signed: Africa Energy Intelligence, no. 301, June 20, p. 7.

Africa Energy Intelligence, 2002, Ethiopia—Inquiry into Midroc award: Africa Energy Intelligence, no. 314, January 16, p. 6.

British Geological Survey, 2002, World mineral statistics 1996-2000: Keyworth, United Kingdom, British Geological Survey, 304 p.

Gebre-Selassie, Wonde, 2000, Ethiopia, *in* Mining annual review 2000: London, United Kingdom, Mining Journal Ltd. CD-ROM.

Gebre-Selassie, Wonde, 2001, Ethiopia, *in* Mining annual review 2001: London, United Kingdom, Mining Journal Ltd. CD-ROM.

Henricus, Jennifer, 2001a, Mining and marketing Somaliland's resources: Jewellery News Asia, no. 195, January, p. 63.

Henricus, Jennifer, 2001b, Rich gemstone potentials discovered in Somaliland: Jewellery News Asia, no. 195, January, p. 58-63.

Henricus, Jennifer, 2002, Mining deregulation in Ethiopia set to spur more gem exploration: Jewellery News Asia, no. 209, January, p. 50-62.

International Cement Review, 2001a, Djibouti, *in* Global cement report: Dorking, United Kingdom, Tradeship Publications, Ltd., p. 124.

International Cement Review, 2001b, Somalia, *in* Global cement report: Dorking, United Kingdom, Tradeship Publications, Ltd., p. 266.

International Monetary Fund, 2000, Eritrea—Statistical annex: Washington, DC, International Monetary Fund, May 11, 58 p.

International Monetary Fund, 2002a, Ethiopia—Second review under the three-year arrangement under the poverty reduction and growth facility, requests for augmentation of access and for waiver of performance criterion, and second annual program—Staff report and news brief on the executive board discussion: Washington, DC, International Monetary Fund, March 26, 77 p.

International Monetary Fund, 2002b, World economic outlook—Recoveries and recessions: Washington, DC, International Monetary Fund, April, 225 p.

Iran Daily, 2001, TFE signs up in Somalia: Iran Daily, February 7, p. 5.

Resource Information Unit, 2001a, Eritrea, *in* Register of African mining 2001/02: Subiaco, Australia, Resource Information Unit, p. 90-94.

Resource Information Unit, 2001b, Ethiopia, *in* Register of African mining 2001/02: Subiaco, Australia, Resource Information Unit, p. 95-97.

Sub-Sahara Resources NL, 2002, Annual report 2001: Perth, Australia, Sub-Sahara Resources NL, 44 p.

Teklemariam, Meseret, Beyene, Kibret, Yihenis A.B., Gebregziabher, Zewde, 2000, Geothermal development in Ethiopia—Proceedings of the World Geothermal Conference 2000, Tohuku, Japan, May 28-June 10, 2000: Tohuku, Japan, International Geothermal Association, p. 475-480.

Digitized by Google

Washington Post, 2001, 9 charity workers abducted: Washington Post, March 28, p. A18.
Weeden, Scott, 2001, GTL—Progress and prospects—Financial commitments brighten: Oil & Gas Journal, v. 99, no. 11, March, p. 58-63.
World Bank, 2001a, Memorandum and recommendation of the president of the International Development Association to the executive directors on a proposed supplemental credit of SDR 34.7 million to the Federal Democratic Republic of Ethiopia for the national fertilizer sector project: Washington, DC, World Bank, May 18, 18 p.
World Bank, 2001b, The Republic of Djibouti—Interim poverty reduction strategy paper and joint IDA-IMF assessment: Washington, DC, World Bank, November 6, 35 p.
World Resources Institute, United Nations Environment Program, United Nations Development Program, and World Bank, 1996, World resources 1996-97: Oxford, United Kingdom, Oxford University Press, 365 p.

Internet References Cited

International Monetary Fund, 2002a, Selected world aggregates, World Economic Outlook Database, accessed June 13, 2002, at URL http://www.imf.org/external/pubs/ft/weo/2001/ 03/data/wl.csv.
International Monetary Fund, 2002b, Shares of aggregate GDP based on purchasing power parity (PPP) valuation of country GDP—Developing countries, World Economic Outlook Database, accessed June 13, 2002, at URL http://www.imf.org/external/pubs/ft/weo/2001/ 03/data/ppp_c.csv.
Ministère de l'Economie des Finances et de la Planification, chargé de la Privatisation, 2001, Electricité produite et livrée par l'electricite de Djibouti (1986-2000), accessed March 11, 2002, at URL http://www.mefpp.org/elect00.htm#electri00.
National Bank of Ethiopia, September 2001, Energy production, Annual Report 2000/2001, accessed May 13, 2002, at URL http://www.telecom.net.et/~nbe/ NBEPublications/AnnualNew_Index.htm.
U.S. Commercial Service, 2001, Eritrea —Leading sectors for U.S. exports and investments, Country Commercial Guide FY 2002, accessed March 27, 2002, at URL http://www.usatrade.gov/website/ccg.nsf/CCGurl/CCG-ERITREA2002-CH-5:-00508DA1.
U.S. Energy Information Administration, March 2002, Horn of Africa, Country Analysis Brief, accessed March 27, 2001, at URL http://www.eia.doe.gov/emeu/cabs/hornafrica.html.

Digitized by Google

TABLE 1
ERITREA, ETHIOPIA, AND SOMALIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Country and commodity		1997	1998	1999	2000	2001 e/
ERITREA						
Basalt		489,686	403,219	251,991 r/	122,928 r/	129,000
Cement e/		60,000	50,000	57,000 r/	45,000	47,300
Clays:						
Common e/		80,000	80,000	88,476 r/ 2/	63,427 r/ 2/	66,600
Kaolin		4,670	3,809	1,138 r/	943 r/	990
Coral		96,535	245,112	86,762 r/	74,130 r/	77,800
Gold	kilograms	612	573	534 r/	264 r/	270
Granite		111,062	249,829	162,146 r/	122,017 r/	128,000
Gravel		798,055	941,129	152,968 r/	115,110 r/	121,000
Gypsum		27	56	1,075 r/	330 r/	345
Laterite		585	5,881	2,171 r/	2,049 r/	2,150
Lime e/		7,000	6,000	6,000 r/	3,000	3,000
Limestone 3/		5,585	4,077	5,069 r/	2,690 r/	2,830
Marble e/		220,000	200,000	200,000 r/	100,000	105,000
Petroleum products	thousand 42-gallon barrels	3,000	--	--	--	--
Pumice		754	391	153 r/	41 r/	40
Quartz		604	731	730 e/	600 e/	630
Salt		252,073	114,137	9,368 r/	47,498 r/	49,900
Sand	thousand tons	2,097	2,170	809 r/	1,030 r/	1,080
Silica sand		27	--	10,065 r/	--	10,000
ETHIOPIA 4/ 5/						
Cement, hydraulic		752,000	750,000	638,266	879,962	950,000
Clays: 6/						
Brick e/		6,000	6,000	80,865 2/	224,093 2/	242,000
Kaolin (China clay)		3,512	378	681	1,654	1,790
Other clay	cubic meters	NA	NA	23,750	23,000 e/	24,800
Columbite-tantalite, ore and concentrate:						
Gross weight	kilograms	20,000	20,000	49,630	64,940	78,700
Nb content	do.	NA	NA	4,960	6,490	7,870
Ta content	do.	6,500	6,500	29,300	38,800	47,000 2/
Diatomite		150	125	140	140 e/	150
Feldspar e/		5,000	5,000	391 2/	285 2/	310
Gold, mine output, Au content	kilograms	3,000	2,500	4,905	5,177	5,200
Gypsum and anhydrite, crude		120,000	120,000	35,983	46,798	50,500
Lime		2,500	3,000	2,991	3,769	3,800
Pumice e/ 6/		325,000	325,000	135,400 2/	156,466 2/	169,000
Salt, rock e/		1,000	1,000	56,400 2/	56,400 2/	60,900
Scoria e/		250,000	250,000	281,164 2/	287,000	310,000
Soda ash, natural		15,000	15,000	4,745	4,745	5,000
Stone, sand and gravel: e/ 6/						
Construction stone, crushed	thousand tons	750	1,000	3,407 2/	3,459 2/	3,740
Dimension stone 7/		40,000	130,000	130,000	100,000	108,000
Granite		NA	NA	126 2/	140	150
Limestone	thousand tons	3,300	3,400	846 2/	1,197 2/	1,300
Sand 8/	do.	1,600	2,500	1,600 2/	1,853 2/	2,000
Silica sand		7,000	7,000	6,061 2/	5,601 2/	6,050
Other stone		NA	NA	10,162 2/	15,768 2/	17,000
SOMALIA 9/ e/						
Gypsum		1,000	1,500	1,500	1,500	1,500
Salt, marine		800	600	1,000	1,000	1,000
Sepiolite (meerschaum)		6	6	6	6	6

e/ Estimated; estimated data are rounded to no more than three significant digits. r/ Revised. NA Not available. -- Zero.

1/ Includes data available through March 29, 2002.

2/ Reported figure.

3/ For other than cement.

4/ Data are for year ending July 7 of the year listed.

5/ In addition to the commodities listed, some lignite, semiprecious gemstones, steel semimanufactures, and talc reportedly were produced, and silver and platinum were reportedly contained in gold ingots from the Lega Dembi Mine, but information is inadequate to estimate output.

6/ When reported as volume or pieces, conversions to metric tons are estimated.

7/ Includes marble. Production of marble was estimated to be 13,900 t in 1996 and reported to be 6,014 t in 1999 and 6,662 t in 2000.

8/ May include gravel.

9/ In addition to the commodities listed, various crude construction materials (e.g., clays, sand and gravel, crushed and dimension stone) and limestone for lime manufacture and/or agriculture are presumably produced; available information, however, is inadequate to make estimates of output.

Digitized by Google

THE MINERAL INDUSTRY OF

EGYPT

By Philip M. Mobbs

Crude petroleum and refined petroleum products have dominated Egypt's mineral sector in recent decades; the economic significance of natural gas output, however, has increased recently at a rapid rate. In 2001, Egypt was the 19th leading crude oil producer in the world. The country's natural gas production of 21 billion cubic meters ranked as the 22d leading natural gas producer compared with 1991 when its 7.8-billion-cubic-meter output ranked 27th among the world's gas producers (BP plc, 2002; U.S. Energy Information Administration, 2002). Egypt was a modest producer of primary aluminum, ferroalloys, iron ore, and steel; had secondary (recycle and remelt) production of copper, lead, and zinc; and had a history of mining construction materials (such as clay, dimension stone, and gypsum), gemstones, gold, and raw materials for glass. The recent expansion of the cement, fertilizer, and steel industries has been propelled by the Government's privatization program, private development of new facilities, expansion of privatized operations, and the construction boom associated with the Government's promotion of resettlement and industrial development. The former fast growth of the cement sector, however, appeared to have begun to flag in association with the national construction industry slowdown that began in 2000.

The population of this North African nation was estimated to be about 65 million. The nation's nominal gross domestic product (GDP) was estimated to be $96.3 billion[1] in 2001 (International Monetary Fund, 2002§[2]). Despite the decline in international oil prices in 2001, the segments of the Egyptian GDP at factor cost for the July 1, 2000, to June 30, 2001, Egyptian fiscal year (the last period for which disaggregated data were available) remained steady. Segments included industry, manufacturing, and mining, which were combined to account for 19.2% of the GDP; transportation (including Suez Canal operations), which accounted for about 9% of the GDP; production of crude petroleum and petroleum products, which accounted for 7.6% of the GDP compared with 7.4% in the fiscal year ending in 2000; and construction, which accounted for 4.76% of the GDP (Ministry of Foreign Trade, 2002a§).

According to the Ministry of Foreign Trade (2002b§), Egypt's total exports in 2001 were valued at about $4.1 billion compared with more than $4.7 billion in 2000, and total imports amounted to $12.6 billion in 2001 compared with $14.0 billion in 2000. Crude oil and petroleum products accounted for about $1.6 billion, or 39% of the value of total exports in 2001 compared with about $1.9 billion (41%) in 2000. In 2001, the value of fuel imports was down to $571 million compared with $1.0 billion in 2000. For the fiscal year ending June 30, 2001, foreign direct investment was about $509 million, significantly down from $1.66 billion for fiscal year 2000 (Central Bank of Egypt, undated§).

[1]Where necessary, values have been converted from Egyptian pounds (E£) to U.S. dollars (US$) at the rate of E£4.06=US$1.00.

[2]References that include a section twist (§) are found in the Internet References Cited section.

Commodity Review

Metals

Gold.—In 2001, Cresset International Ltd. (a subsidiary of Cresset Precious Metals, Inc. of the United States) undertook geochemical, geologic, and geophysical studies of the Umm Tundub mine area on its Hamash property and submitted a feasibility study for the development of its eight properties in the Eastern Desert. In December, Cresset received a 30-year concession on the properties which included the Gali, Hamash, Hamata, Northwest Al-Bida, West Al-Bida, Umm Hugab, Umm Sumuqi, and Wadi Khasheba areas.

In November, Pharaoh Gold Mines NL (a subsidiary of the Australian company Centamin Egypt Ltd.) and the Egyptian Geological Survey and Mining Authority (EGSMA) were awarded an exploration (mining) lease in the Eastern Desert. The concession area included the Abu Marawat, the Barramiya, the Hamama, and the Sukari deposits. Drilling and trenching continued on the Sukari deposit. Measured gold resources were reported to be 9.3 million metric tons (Mt) of ore at a grade of 1.41 grams per metric ton (g/t) gold at a cutoff grade of 0.5 g/t. An open pit optimization study and an engineering study for a 2-million-metric-ton-per-year (Mt/yr)-capacity carbon-in-leach processing plant were completed. A feasibility study was underway (Centamin Egypt Ltd., 2001, 2002).

Iron and Steel.—In Sadat City, Egyptian American Steel Rolling Co.'s 500,000-metric-ton-per-year (t/yr)-capacity bar and wire rod rolling mill was commissioned and reached a production rate of about 300,000 t/yr by yearend. Also completed in 2001 was the construction of an additional 500,000-t/yr bar mill for Egyptian American Steel. Initial production from the bar mill was deferred pending resolution of personnel and technical issues (MEsteel.com, 2002§).

Tantalum.—In October, the EGSMA and Tantalum International (a subsidiary of Gippsland Ltd. of Australia) formed Tantalum Egypt to develop the Abu Dabbab tantalum deposit. Previous exploration campaigns had estimated that tantalum resources of the deposit were about 48 Mt at a grade of 274 g/t tantalum pentoxide (Metal Bulletin, 2002).

Digitized by Google

Industrial Minerals

Cement.—Egyptian Cement Co. [a joint venture that included Orascom Construction Industries of Egypt (53.6% equity interest) and Holderbank Financière Glaris Ltd. of Switzerland (43.72%)] continued the construction of their fourth kiln.

As part of the Government's 2001 privatization program, ASEC Cement Co. (owned in part by Arab Swiss Engineering Co.) acquired an additional 47.9% equity interest in Helwan Portland Cement Co., adding to its formerly held 3.5% interest. Ciments Français acquired 25% interest in Suez Cement Co. and was named a strategic partner of Suez.

In November, South Valley Cement Co. announced that it planned to liquidate itself and offered to repurchase 70% of its shares. The faltering construction sector had thwarted the company's ability to raise capital to finance a proposed 1.4-Mt/yr-capacity cement plant (Cairo & Alexandria Stock Exchanges, 2002§; CARANA Corporation, 2002§).

Feldspar.— In 2001, Alkhobara Industrial Co. initiated red and white feldspar production from its mines in the Eastern Desert.

Perlite.—The 55,000-cubic-meter-per-year-capacity Egyptian Co. for Manufacturing Perlite and Vermiculite began operations in late 2000 (Incon Corp., undated§).

Mineral Fuels

Egypt's energy minerals sector was dominated by the production of natural gas, crude petroleum, and refined petroleum products. There was some coal production from the Maghara Mine in the northern Sinai. The U.S. Department of Energy's December 2001 overview of the Egyptian energy sector can be found at URL http://www.eia.doe.gov/cabs/egypt2.html.

Natural Gas.—In 2001, the Government estimated that Egyptian natural gas reserves were nearly 1.6 trillion cubic meters (U.S. Energy Information Administration, 2001§). In August, the Government formed the Egyptian Natural Gas Holding Co. (EGAS) as a 100% subsidiary of Egyptian General Petroleum Corp. (EGPC). EGAS became the Government agency responsible for the development of natural gas export projects. Liquefied natural gas (LNG) projects in Egypt included Grupo Union Fenosa of Spain's $1 billion 5-Mt/yr-capacity LNG train at Damietta (Halliburton Co., 2001). In December, Union Fenosa selected M.W. Kellogg Ltd. of the United Kingdom (a subsidiary of Halliburton KBG Group of the United States and JGC Corp. of Japan) and Técnias Reundas S.A. of Spain for the engineering, procurement, and construction contract. The LNG plant's first train was scheduled to be built and operating by 2004. Site preparation had begun in 2000. A second train was proposed to be operational in 2006, dependent upon demand.

BG Group plc and Edison International proposed to build a $900 million 3.6-Mt/yr LNG plant near Idku, east of Alexandria (Middle East Economic Digest, 2001b; Flower, 2002). BP plc proposed to construct a two-train LNG plant and a two-train natural gas liquids plant at Damietta, and Royal Dutch/Shell Group proposed to construct a barge-mounted two-train LNG plant and gas-to-liquids plant.

The Governments of Egypt, Jordan, Lebanon, and Syria agreed to a proposal to provide Egyptian natural gas to the three countries. The original plan for an offshore pipeline to Lebanon and subsequent overland distribution to Jordan and Syria was replaced in February by a proposal to pipe Egyptian gas across the Sinai to Aqaba, Jordan, and subsequent extension of the line north to Lebanon and Syria. In June, the initial $330 million, 260-kilometer (km) pipeline segment to Aqaba was approved. In September, Jordan requested bids for a 370-km extension of the proposed pipeline to Amman, Jordan (Middle East Economic Digest, 2001a, c). The Government also held talks with the Government of Cyprus concerning oil and gas exploration in the eastern Mediterranean Sea and an eventual extension of the gas pipeline from Syria.

Refined Petroleum.—In 2001, petroleum product production began at the 100,000-barrel-per-day-capacity Middle East Oil Refinery (MIDOR) in the Al-Ameriya free zone of Alexandria (U.S. Energy Information Administration, 2001§). The National Bank of Egypt added to its 10% equity interest in MIDOR when it acquired an additional 20% interest from an Irish subsidiary of Merhav Ltd. of Israel and an additional 6% interest from the private company Masaka. The state-owned EGPC held 40% equity interest, and EGPC's subsidiaries (Engineering for the Petroleum and Process Industries and Petroleum Projects and Technical Consultation Co.) each held 10% equity interest in MIDOR. The divestment of the Israeli interest in MIDOR eliminated some of the crude oil supply problems that had been associated with the refusal of many of the Arabian Gulf region Government oil companies to deal with MIDOR.

References Cited

BP plc, 2002, BP statistical review of world energy: London, United Kingdom, BP plc, 40 p.

Centamin Egypt Ltd., 2001, Annual report—2001: Mount Pleasant, Australia, Centamin Egypt Ltd., September 2001, 40 p.

Centamin Egypt Ltd., 2002, Report for quarter ended 31 December 2001: Mount Pleasant, Australia, Centamin Egypt Ltd., January 29, 5 p.

Flower, Andy, 2002, Market access remains key for LNG producers: Oil & Gas Journal, v. 100, no. 16, April 22, p. 74-80.

Halliburton Co., 2001, Halliburton KBR and partners awarded $1 billion Egyptian LNG project: Dallas, Texas, Halliburton Co. press release, December 19, 2 p.

Metal Bulletin, 2002, Australian firm plans tantalum project in Egypt: Metal Bulletin, no. 8640, January 14, p. 8.

Middle East Economic Digest, 2001a, Go-ahead for Egypt-Jordan gas line: Middle East Economic Digest, v. 45, no. 24, June 15, p. 11.

Middle East Economic Digest, 2001b, Societe Generale poised for Idku: Middle East Economic Digest, v. 45, no. 37, September 14, p. 9.

Middle East Economic Digest, 2001c, Tenders—Jordan—Gas pipeline: Middle East Economic Digest, v. 45, no. 36, September 7, p. 39.

U.S. Energy Information Administration, 2002 (August), International Energy, *in* Monthly energy review: Washington, DC, U.S. Energy Information Administration, p. 145-147.

Digitized by Google

Internet References Cited

Cairo & Alexandria Stock Exchanges, 2002, Disclosure—Companies news, accessed October 24, 2002, via URL http://www.egyptse.com/messages.asp?msgtype=companies%20news.

CARANA Corporation, 2002 (April 24), South Valley Cement purchases 13.2% of its shares from the stock market, Privatization-Related Articles from the Arabic Press, accessed August 12, 2002, at URL http://www.carana.com/pcsu/press/2002-Apr-24.htm.

Central Bank of Egypt, [undated], Table 19—Net foreign direct investment in Egypt by country, Monthly Statistical Bulletin, accessed October 28, 2002, at URL http://www.cbe.org.eg/17%20-Net%20Foreign%20Direct%20Investment%20In%20Egypt%20(FDI)%20by%20country.htm.

Incon Corp., [undated], First expanded perlite production in Egypt, accessed March 19, 2002, at URL http://www.incon-corp.com/an/an03.htm.

International Monetary Fund, 2002 (September), Gross domestic product—Current prices, World Economic Outlook Database, accessed October 28, 2001, at URL http://www.imf.org/external/pubs/ft/weo/2002/02/data/index.htm.

MEsteel.com, 2002 (March 14), Egypt—American Steel Rolling commissions second bar mill line, accessed October 28, 2002, at URL http://www.mesteel.com/news/local_news_35.htm.

Ministry of Foreign Trade, 2002a (October), Gross domestic product at factor cost, Monthly Economic Digest, accessed October 28, 2002, at URL http://www.moft.gov.eg/English/Statistical_Annex/Monthly/2b_GDP.stm.

Ministry of Foreign Trade, 2002b (October), International trade by major commodity groups, Monthly Economic Digest, accessed October 28, 2002, at URL http://www.moft.gov.eg/English/Statistical_Annex/Monthly/5e_1Trade.stm.

U .S. Energy Information Administration, 2001 (December), Egypt, accessed January 20, 2002, at URL http://www.eia.doe.gov/cabs/egypt2.html.

TABLE 1
EGYPT: PRODUCTION OF MINERAL COMMODITIES 1/

(Thousand metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000 e/	2001 e/
METALS						
Aluminum metal	metric tons	178,200	195,000	193,319	193,000 r/	189,000
Copper, refined, secondary e/	do.	5,000	6,000	6,000	5,000	5,000
Iron and steel:						
Iron ore and concentrate		2,744	3,001	2,700 r/ e/	2,500	2,500
Metal:						
Pig iron e/		1,000	1,334 2/	700	700	700
Direct reduced iron		1,190	1,610	1,670	1,530 2/	2,370
Steel, crude		2,717	2,870	2,619	2,820 2/	3,800
Ferroalloys: e/						
Ferromanganese		26	18	30	30	30
Ferrosilicon		44	44	44	45	40
Manganese ore e/	metric tons	15,000	10,000	20,000	20,000	20,000
Titanium, ilmenite e/		125	125	130	125	125
INDUSTRIAL MINERALS						
Asbestos e/	metric tons	2,000	700	1,000	2,000	20,000
Barite e/		--	300	500	500	500
Cement, hydraulic, all types		19,700	21,000	23,313	24,143 2/	24,500
Clays:						
Bentonite e/		50	33	50	50	50
Fire clay		331	227	300 e/	300	300
Kaolin	metric tons	258,869	285,497	290,000 e/	290,000	290,000
Feldspar, crude	do.	57,335	325,654	330,000 e/	330,000	300,000
Fluorspar	do.	775	140	500 e/	500	500
Gypsum and anhydrite, crude		2,423	1,338	2,000 e/	2,000	2,000
Lime e/		800	800	800	800	800
Nitrogen:						
Ammonia, N content		1,061	1,141	1,407	1,511 2/	1,800 2/
Urea, N content		445	482	700	853 2/	1,091 2/
Phosphate:						
Phosphate rock		1,067	1,076	1,018	1,020	1,450
P_2O_5 content		310	311	298	300	420
Sodium compounds:						
Salt		2,024	2,387	2,400 e/	2,400	2,400
Soda ash e/		50	50	50	50	50
Sodium sulfate	metric tons	2,118	2,498	2,500 e/	2,500	2,500

See footnotes at end of table

Digitized by Google

TABLE 1--Continued
EGYPT: PRODUCTION OF MINERAL COMMODITIES 1/

(Thousand metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000 e/	2001 e/
INDUSTRIAL MINERALS--Continued						
Stone, sand and gravel:						
Basalt	thousand cubic meters	883	241	300 e/	300	300
Dolomite		1,324	3,444	3,500 e/	3,500	3,000
Granite, dimension stone	cubic meters	24,958	35,817	40,000 e/	40,000	40,000
Gravel	thousand cubic meters	12,033	11,463	12,000 e/	12,000	11,000
Limestone and similar	do.	23,559	25,618	27,000 e/	27,000	25,000
Marble (including alabaster) blocks	cubic meters	127,767	134,664	140,000 e/	140,000	140,000
Sand:						
Industrial sand (glass sand)		505	574	600 e/	600	600
Construction sand		21,250	19,420	22,000 e/	22,000	21,000
Sandstone	thousand cubic meters	66	6	-- e/	--	10
Sulfur:						
Elemental, byproduct e/	metric tons	4,453 2/	4,450	4,400	4,500	4,500
Sulfuric acid, S content		230	224	214	220	220
Talc, soapstone, pyrophyllite	metric tons	43,627	39,720	40,000 e/	40,000	40,000
Vermiculite	do.	447	12,376	12,000 e/	12,000	12,000
MINERAL FUELS AND RELATED MATERIALS						
Coal e/		300	370 2/	400	400	400
Coke e/		1,800	1,500	1,420	1,400	1,400
Gas, natural:						
Gross production	million cubic meters	17,000 e/	18,270	19,766	25,000	25,000
Dry	do.	13,349	16,430	17,800 e/	21,000	21,000
Petroleum:						
Crude, including condensate	thousand 42-gallon barrels	319,000 r/	313,000 r/	302,000 r/	285,000 r/	277,000
Refinery products:						
Liquified petroleum gas	do.	6,333	5,090	5,371	5,500	5,500
Gasoline and naptha	do.	44,065	43,465	43,699	45,000	45,000
Kerosene and jet fuel	do.	16,606	15,788	15,472	16,000	16,000
Distillate fuel oil	do.	43,790	45,230	45,857	46,000	46,000
Residual fuel oil	do.	86,100	87,625	82,011	83,000	83,000
Lubricants	do.	1,729	1,820	1,834	1,800	1,800
Asphalt	do.	4,641	5,042	6,030	6,000	6,000
Unspecified 3/	do.	2,400	2,350	1,987	1,700	1,700
Total	do.	205,664	206,410	202,261	205,000	205,000

e/ Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. r/ Revised. -- Zero.
1/ Table includes data available through October 28, 2002. In addition to those listed, Egypt produced a number of commodities for which data were unavailable; these include a number of metals, such as lead, which was produced from recycled material and manufactured mineral commodities, such as carbon black and glass.
2/ Reported figure.
3/ Amounts needed to complete reported refinery products totals shown.

Digitized by Google

THE MINERAL INDUSTRY OF

EQUATORIAL GUINEA

By Philip M. Mobbs

The Republic of Equatorial Guinea consists of a number of islands and the Rio Muni enclave on the African mainland. Equatorial Guinea's rapid economic growth since 1996 has been associated with successful offshore petroleum development. Described as a "future African Kuwait," the nation has attracted the attention of international petroleum companies because of its prospective offshore petroleum plays (Africa Energy Intelligence, 2001; Johnston, 2001§[1]).

In 2001, the gross domestic product (GDP) of Equatorial Guinea was estimated to be $1.9 billion, and the population was estimated to be 486,000 (International Monetary Fund, 2002§; U.S. Central Intelligence Agency, 2002§). A wide range of estimated values for the GDP has been published; estimates for 2000 ranged from $960 million to $1.34 billion to $1.44 billion (International Monetary Fund, 2002§; U.S. Central Intelligence Agency, 2002§; World Bank, 2002§).

Government Policies and Programs

Mineral resources are the property of the State. Exploration and production contracts are administered by the Ministry of Mines and Energy. In 2001, the Mining Law (Decree Law No. 9/1981) was under revision. Most nonfuel minerals exploration contracts were available as 1- to 3-year exploration licenses on permits up to 500 square kilometers (km²). Exploration licenses for diamond could be issued for areas up to 1,000 km² (Ministry of Mines and Energy, 2001a§).

Oil and natural gas exploration and production were regulated by Decree Law No. 7/1981, as amended (table 2). The model petroleum-production-sharing contract was revised in 1998. Initial exploration contracts could be drawn up for 5-year periods, divided into a 3- and a 2-year subperiod, with two 1-year extensions. In 2001, annual surface rents during exploration were $0.50 per hectare in water depths of greater than 200 meters (m) and $1.00 per hectare for concessions in less than 200 m of water. During development, surface rents on deepwater concessions rose to $1.00 per hectare. The minimum royalty on petroleum production was 10%, with a 16% maximum. Production sharing was based on a stepped scale. The Government reserved the right to participate in exploration and production ventures. The income tax rate started at 25% with a maximum of 45% (Ministry of Mines and Energy, 2001b§).

Decree Law No. 9/2001 established a national oil company. Reportedly, there were suggestions that the new company, which has been reported in the literature as Petroguinea or Petrogesa (Petroleo de Guinea Ecuatorial) and Geopetrole (Guinea Ecuatorial de Petroleo), would renegotiate existing petroleum licenses (Asociación para la Solidaridad Democrática con Guinea Ecuatorial, 2001§).

Commodity Review

The Rio Muni enclave was reopened for exploration in 2001 when the minerals concession, which until recently had been held by UMC Equatorial Guinea Corp. (an affiliate of Ocean Equatorial Guinea Corp.) expired at the end of 2000. Mineral and geologic surveys of Rio Muni had identified occurrences of a number of minerals, the most notable being gold and titanium-bearing sands (Ministerio de Minas y Energia, 2000, p. 19-20). The Ministry estimated that artisanal miners produced about 500 kilograms per year of gold (Leahy and Abeso, 2001§).

In 2001, the joint venture of CMS Oil & Gas Ltd., Globex International, Samedan of North Africa, Inc., and the Government successfully drilled the Alba-9 and the Estrella-1 condensate and natural gas wells. During 2000 and 2001, the production capacity of the joint venture's Alba Field in the Gulf of Guinea had been increased to nearly 2.5 billion cubic meters per year (Noble Affiliates Inc., 2001, p. 10). The field supplied natural gas at the rate of about 2.8 million cubic meters per day to Atlantic Methanol Production Co. LLC's (AMPCO) 2,500-metric-ton-per-day-capacity methanol plant. About 21 million cubic meters per year of natural gas was used by the 10.4-megawatt Punta Europa electricity generating plant. After April 2001, natural gas not consumed by AMPCO, the Punta Europa powerplant, or the Punta Europa condensate plant was reinjected offshore. Previously unused gas had been flared.

AMPCO had began operations in April and was producing commercial-grade methanol by May. The AMPCO plant was owned by Atlantic Methanol Capital Co. [a joint venture of CMS Energy Corp. and Samedan, (90% equity interest) and the Government (10%)]. In November, Marathon Oil Co. (a subsidiary of USX Corp.) announced that it would acquire CMS Energy's and CMS Oil & Gas' interests in Equatorial Guinea for $993 million in January 2002 (Oil & Gas Journal, 2001b).

The joint venture of Mobil Equatorial Guinea Inc., Ocean Energy Inc., and the Government continued the development of the Zafiro Field on block B with six successful wells. Zafiro, which was the largest oilfield in Equatorial Guinea, produced about 47 million barrels of oil in 2001. Also in 2001, the Oreja Marina-1 well on block C and the Los Loros-1 well and another exploration well on block D were drilled, plugged, and abandoned.

The partnership of Triton Equatorial Guinea, Inc. (a subsidiary of Triton Energy Ltd.), and Energy Africa Ltd.

[1]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

drilled, plugged, and abandoned the F-1 exploratory hole on block F. In August 2001, Amerada Hess Corp. bought Triton Energy for about $3.2 billion (Amerada Hess Corp., 2001). At yearend, drilling of the F-2 exploratory well was underway.

Development of the Ceiba Field on block G continued. Triton Equatorial Guinea and Energy Africa drilled the Ceiba-7, Ceiba-8, Ceiba-9, and Ceiba-10 wells, which were a mix of production and water-injection wells, and production was increased to about 50,000 barrels per day (bbl/d) from 38,000 bbl/d at the beginning of the year (Cottrill, 2001; Amerada Hess Corp., 2002). The Ceiba Field plans called for 12 production wells and 4 water-injection wells (Brian Maxted, oral commun., May 16, 2002). In 2001, crude oil from the Ceiba Field, which was in about 700 m of water, was piped about 6 kilometers to the 60,000 bbl/d-of-liquids-production-capacity floating production, storage, and offloading (FPSO) *Sendje Berge* that was anchored in about 100 m of water (Offshore Engineer, 2001; Oil & Gas Journal, 2001a; Triton Energy Ltd., 2001§). Production capacity limitations of the *Sendje Berge* led to the conversion to a FPSO of the very large crude carrier *Berge Hus,* which was designed with 160,000-bbl/d-of-liquids-production capacity (Amerada Hess Corp., 2002). The converted vessel was renamed the FPSO *Sendje Ceiba* and was scheduled to replace the *Sendje Berge* in January 2002 (Oil & Gas Journal, 2001c).

Triton Equatorial Guinea also successfully drilled the G-5 exploration well, which was renamed the Okume-1; the G-6 exploration well, which was renamed the Oveng-1; and the Okume-2, Okume-3, Okume-4, and the Oveng-2 appraisal wells.

In 2001, Roc Oil Co. Ltd. and the Atlas Group commissioned a three-dimensional seismic survey on block H. Triton Equatorial Guinea acquired 25% interest, and Sasol Petroleum International acquired 10% interest in block L from Chevron Equatorial Guinea Ltd.

References Cited

Africa Energy Intelligence, 2001, U.S. lobbies for CMS Energy: Africa Energy Intelligence, no. 301, June 20, p. 3.

Amerada Hess Corp., 2001, Amerada Hess completes Trition acquisition: New York, New York, Amerada Hess Corp. press release, August 20, 1 p.

Amerada Hess Corp., 2002, Amerada Hess announces first oil production from new FPSO Sendje Ceiba: New York, New York, Amerada Hess Corp. press release, February 13, 1 p.

Cottrill, Adrian, 2001, Speculation brings Ceiba success: Offshore Engineer, January, p. 23-24.

Ministerio de Minas y Energia, 2000, Equatorial Guinea: Malabo, Equatorial Guinea, Ministerio de Minas y Energia Brochure, 20 p.

Noble Affiliates Inc., 2001, Form 10-K—2000: Securities and Exchange Commission, 62 p.

Offshore Engineer, 2001, Ceiba on stage: Offshore Engineer, February, p. 43.

Oil & Gas Journal, 2001a, Deepwater West Africa—Development accelerates: Oil & Gas Journal, v. 99, no. 27, July 2, p. 64-69.

Oil & Gas Journal, 2001b, Marathon to run Alba project off Equatorial Guinea: Oil & Gas Journal, v. 99, no. 46, November 12, p. 51.

Oil & Gas Journal, 2001c, Quick takes: Oil & Gas Journal, v. 99, no. 50, December 10, p. 8.

Internet References Cited

Asociación para la Solidaridad Democrática con Guinea Ecuatorial, 2001 (July 12), Obiang quiere renogociar los contractos con las petroleras, accessed November 8, 2001, at URL http://www.ccoo.es/guinea.ec_democratica/asodegue/hoja127.htm.

International Monetary Fund, 2002 (April), World economic outlook (WEO) database, accessed May 8, 2002, at URL http://www.inf.org/external/pubs/ft/weo/2002/02/data.

Johnston, Cynthia, Reuters Ltd., 2001 (March 28), New oil frontier in Africa's Equatorial Guinea, accessed March 28, 2001, at URL http://biz.yahoo.com/rf/010328/126405578.html.

Leahy, Kevin, and Abeso, J.M., 2001, The gold potential of Equatorial Guinea, accessed October 24, 2001, at URL http://website.lineone.net/~silicondale/ilggm/eqguinea.htm.

Ministry of Mines and Energy, 2001a, Minerals—Legislation, The Hydrocarbons and Mining Industries of Equatorial Guinea, accessed May 7, 2002, at URL http://www.equatorialoil.com/pages/Mineral_Legislation.html.

Ministry of Mines and Energy, 2001b, Petroleum—Legislation, The Hydrocarbons and Mining Industries of Equatorial Guinea, accessed May 7, 2002, at URL http://www.equatorialoil.com/pages/Petroleum_Legislation%20.htm.

Triton Energy Ltd., 2001 (March 15), Form 10-K—Fiscal year 2000, accessed May 2, 2001, at URL http://www.sec.gov/Archives/edgar/data/1009404/000100940401500010/0001009404-01-500010.txt.

U.S. Central Intelligence Agency, 2002, Equatorial Guinea, World Factbook 2002, accessed May 7, 2002, at URL http://www.odci.gov/cia/publications/factbook/geos/ek.html.

World Bank, 2002 (April), World development indicators database, accessed May 7, 2002, via URL http://devdata.worldbank.org/data-query.

Major Source of Information

Ministerio de Minas y Energia
Departmento de Minas y Hydrocarburos
Calle 12 de Octubre
Malabo, Bioko Norte
Equatorial Guinea
Telephone: +(240) 9-3567
Fax: +(240) 9-3353
Internet: http://www.equatorialoil.com

Digitized by Google

TABLE 1
EQUATORIAL GUINEA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES 1/

(Thousand 42-gallon barrels unless otherwise specified)

Commodity 2/	1997	1998	1999	2000	2001
Crude oil and condensate	21,000	30,000	33,000	39,000	69,000
Gold kilograms	500	500	500	500	500
Liquified petroleum gases	450	660	800	800	800
Methanol metric tons	--	--	--	--	600,000
Natural gas 3/ million cubic meters	44	78	83	98	790

-- Zero.

1/ Includes data available through May 1, 2002.

2/ In addition to the commodities listed, Equatorial Guinea presumably produced a variety of crude construction materials (clay, gravel, and sand).

3/ Marketed gas estimate. Total natural gas production was estimated to be about 3 billion cubic meters in 2001 and 800 million cubic meters in 2000.

TABLE 2
EQUATORIAL GUINEA: PETROLEUM LICENSES IN FORCE IN 2001

License	Major equity owners
Alba block/Alba Field	Marathon Oil Co. (a subsidiary of USX Corp. of the United States), 52.38%; 1/ Samedan of North Africa, Inc. (Noble Affiliates Inc. of the United States), 33.75%; Globex International (Globex Energy, Inc. of the United States), 10.87%; Government, 3%.
Block B	Mobil Equatorial Guinea Inc. (ExxonMobil Corp. of the United States), 71.25%; Ocean Equatorial Guinea Corp. (Ocean Energy Inc. of the United States), 23.75%; Government, 5%.
Block C	Mobil Equatorial Guinea Inc., 47%; Ocean Equatorial Guinea Corp., 37.6%; SK Corp. of the Republic of Korea, 9.4%; Government, 6%.
Block D	Marathon Oil Co., 37.6%; 1/ Ocean Equatorial Guinea Corp., 37.6%; Mobil Equatorial Guinea Inc., 24.8%.
Block E	TotalFinaElf Group of France, 70%; Braspetro (Petróleo Brasileiro Internacional S.A. of Brazil), 30%.
Block F	Triton Equatorial Guinea, Inc. (Amerada Hess Corp. of the United States), 85%; 2/ Energy Africa Ltd. of South Africa, 15%.
Block G (Ceiba Field)	Triton Equatorial Guinea, Inc., 85%; Energy Africa Ltd., 15% (Triton Equatorial Guinea, Inc., 80.75%; Energy Africa Ltd., 14.25%; Government, 5% carried interest).
Block H	Roc Oil Co. Ltd. of Australia, 60%; Atlas Group (Atlas Petroleum International Ltd. of Nigeria and Osborne Resources Ltd.), 40%.
Block I	Atlas Petroleum International Ltd., 100%.
Block J	Do.
Block K	Vanco Equatorial Guinea, Ltd. (Vanco Energy Co. of the United States), 100%.
Block L	Chevron Equatorial Guinea Ltd. (ChevronTexaco Corp. of the United States), 65%; Triton Equatorial Guinea, Inc., 25%; Sasol Petroleum International (Sasol Ltd. of South Africa), 10%.
Block N (under negotiation)	Petronas Carigali Overseas Sdh. Bhd. (Petroliam Nasional Bhd. of Indonesia), 60%; Ocean Equatorial Guinea Corp., 30%; Vanco Equatorial Guinea, Ltd., 10%. The Government, through the state oil company, Guinea Ecuatorial de Petroleo, can acquire a 15% carried interest in block N.

1/ Interest formerly held by CMS Oil and Gas (Equatorial Guinea) Ltd. (a subsidiary of CMS Energy Corp. of the United States).

2/ During 2001, Amerada Hess Corp. of the United States acquired Triton Energy Ltd. of the United States, which owned Triton Equatorial Guinea, Inc.

Digitized by Google

Digitized by Google

THE MINERAL INDUSTRIES OF

THE GAMBIA, GUINEA-BISSAU, AND SENEGAL

By Philip A. Szczesniak

THE GAMBIA

The mineral industry, which includes some oil exploration and production of clays for brick, laterite, sand and gravel, and silica sand, was a minor component of the Gambian economy. Other mineral resources include ilmenite, rutile, tin, and zircon. The Gambian economy, which had a gross domestic product (GDP) of $2.34 billion based on 2001 purchasing power parity data was dominated by agriculture and tourism (International Monetary Fund, 2002§[1]). The Gambia's population in 2000 was estimated to be about 1.3 million (World Bank, 2001c§).

The Geological Unit of the Department of State for Trade, Industry, and Employment is responsible for the administration of the mining sector. The Government has encouraged onshore exploration for gold and offshore exploration for oil. A new mineral and mining act is being written. The existing mining laws allow for 1-year exploration permits with 1-year renewals and 25-year mining leases with 25-year renewals (Resource Information Unit, 2002, p. 303; MBendi Information Services (Pty.) Ltd., 2001§).

In May 2001, Carnegie Corporation Ltd. of Australia announced that results from new tests on the mineral sands stockpile at Brufut indicated higher resources of zircon than had been previously estimated. Carnegie held a 51% interest in the deposit, and the Gambian Government held the remaining 49% (Africa Mining Intelligence, 2001). In addition to zircon, Carnegie also has resources of ilmenite, rutile, and silica sand (Carnegie Corp. Ltd., undated§). The Gambian Government was also seeking interested investors to exploit other quartz sand deposits at Abuko, Bakendik, Darsilami, Kaiaf, and Mbankam.

In September, the African Development Bank Group approved a $12.35 million loan to The Gambia to mitigate beach erosion along the coastline and sedimentation at the Barra Ferry Terminal. Economic goals of this work were to improve accessibility to tourist centers, to increase availability of hotel and restaurant facilities, and to increase income to locals (African Development Bank Group, 2001c§).

GUINEA-BISSAU

Mineral production in Guinea-Bissau was not significant in 2001. Mining activities in the country were limited to small-scale production of construction materials, such as clay, granite, limestone, and sand. Bauxite, diamonds, gold, and phosphate were among the most promising minerals in the country owing to their potential for economic development. Agriculture accounted for about 60% of Guinea-Bissau's GDP which was $1.26 billion based on 2001 purchasing power parity data (International Monetary Fund, 2002§). Guinea-Bissau's population in 2000 was estimated to be about 1.2 million (World Bank, 2001a§).

In 2000, a new Government was elected in Guinea-Bissau; the election was seen as another step toward ending military conflicts that followed a military coup in June 1998. The Ministry of Natural Resources and Energy is responsible for the administration of the mining sector. In November 1999, the Government of Guinea-Bissau passed a new mining law to reform mineral exploration and mine development and production. The Mines and Minerals Act allows a maximum lease size of 10,000 hectares (ha) for exploration and mining, an unlimited area for prospecting licenses, and 1 to 4 ha (contiguous) for artisanal mining. Mining leases are valid for 25 years and can be automatically renewed upon application. Prospecting licenses are granted for 2-year periods with unlimited renewals.

In April, Champion Resources, Inc., of Canada (CRI) announced that it had begun a diamond exploration program after results of a baseline sampling program conducted in 2000 yielded positive results; two out of eight samples collected from streams in eastern Guinea-Bissau contained kimberlites with orthopyroxenes and garnets. Company officials also noted that an additional 120 samples were being evaluated (African Mining Bulletin, 2001).

CRI announced in March that negotiations for the sale of its Farim deposit with an unnamed phosphoric acid producer had broken down. CRI, which acquired the Farim deposit in 1997, was reported to be seeking a buyer in India or in the Middle East. The Farim deposit had a phosphate resource of 166 million metric tons (Mt) at a grade of about 29% phosphorus pentoxide with an estimated mine life of 25 years (Industrial Minerals, 2001).

In July, Premier Oil plc of the United Kingdom announced an agreement with Petrobank Ltd. of Canada and Petroguin, the national oil company of Guinea-Bissau, to explore for oil on Guinea-Bissau's blocks 2, 4A, and 5A. The three blocks are each located about 130 kilometers (km) offshore in water depths that range up to 1 km. In return for paying for the operation, Premier obtained a 55% ownership with Petrobank controlling 15% and Petroguin controlling 30% (Africa Energy

[1]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

Intelligence, 2001a). Other foreign oil companies with interests in Guinea-Bissau were Fortesa Oil Exploration Co. of the United States and Fusion Oil and Gas plc of Australia.

Refined petroleum products were imported. Fuel products were distributed by Distribudora de Combustiveis e Lubrificantes and Petrogal, which was a Portuguese oil company that operated in Bissau. The organization responsible for the generation and transmission of electricity was the state-owned Instituto Nacional de Energia.

In March 2001, the African Development Bank Group approved a $1.21 million grant to finance a study on how to improve the road connecting the cities of Boke, Guinea, and Quebo, Guinea-Bissau. Work expected to be accomplished as part of the study include an economic and feasibility analysis, a socioeconomic analysis, an environmental impact assessment, an engineering analysis, and a preparation of tender documents (African Development Bank Group, 2001a§).

SENEGAL

Senegal's mineral sector activity was dominated by phosphate rock production and gold and petroleum exploration. Most of the phosphate rock produced by the country was processed domestically and converted to fertilizers and phosphoric acid. Gold was produced in minor amounts, although many foreign companies had active exploration permits in the southeastern part of the country where Precambrian (Birimian) metamorphic rocks are exposed. Other mineral resources include clays, iron ore, marble, peat, salt, and titanium. The Senegalese economy, which had a GDP of $20.61 billion based on 2001 purchasing power parity data, was dominated by agriculture and fish processing (International Monetary Fund, 2002§). The population of Senegal in 2000 was estimated to be about 9.5 million (World Bank, 2001b§).

In 2000, a new Government was elected in Senegal. Among a number of priorities outlined by the President were the increase of agricultural production and the development of the country's inadequate infrastructure by improving the highway system, modernizing the railroads, and constructing a new airport (Craig, 2000). The Ministère des Mines, de l'Energie et de l'Hydraulique is responsible for the administration of natural resources; the Direction des Mines et de la Géologie is responsible for the mining sector; the Direction de l'Energie is responsible for the energy sector.

The Government estimated that production of gold was 550 kilograms per year, all of which was artisanal production. Société Miniere de Sabodala continued to search for partners for its gold operations at Sabodala where significant reserves of gold have been reported (Direction des Mines et de la Geologie, 2000a§). Avgold Ltd. of South Africa, Cluff Mining plc of the United Kingdom, IAMGOLD Corporation of Canada, and Randgold Resources Ltd. of South Africa were among the companies that had active exploration permits in Senegal in 2001.

In November, Randgold Resources announced that they signed an exploration convention with the Senegalese Government. The company noted that preliminary work had identified several promising areas for gold deposits in the Kanoumering region in eastern Senegal (Mining Journal, 2001).

Significant iron ore reserves have been estimated in the Faleme deposit and in the Farangalia and the Goto deposits. Societe des Mines de Fer du Senegal Oriental (MIFERSO) [a joint venture between the Government of Senegal (28%), the Bureau de Recherches Geologiques et Minieres of France (24%), AGEM Ltd. of Canada (24%), and ThyssenKrupp of Germany (24%)] forecast production of 12 million metric tons per year (Mt/yr) of iron ore from these deposits. An estimated $800 million will be needed for the development of the mines and the construction of a railway and mineral port (Direction des Mines et de la Geologie, 2000b§; U.S. Department of State, 2001§).

Ciments du Sahel S.A. of Senegal continued to plan for the construction of a cement plant. The plant will have a capacity of 600,000 metric tons per year (t/yr) of cement and will be located about 50 km southeast of Dakar. The project was being financed by the Danish Export Credit Fund, the World Bank's International Finance Corporation, and other international and regional development banks (F.L.Smidth Group, 2001§).

Phosphate was produced at the Taiba Mine, which was operated by Compagnie Senegalaise des Phosphates de Taiba. Other phosphate deposits exist in the country. The Matam deposit, which contains reserves of 40.5 Mt, was among the country's future targets for exploitation. Industries Chimiques du Senegal planned to invest $1 million in the construction of a new phosphate mine in the Matam area. Overall, phosphate production contributed about 17% of Senegal's export earnings in 2001 (Mining Journal, 2000).

Senegal's oil industry was regulated by the Ministry of Energy, Mines and Industries. The national oil company Société des Petroles du Senegal (PETROSEN) was responsible for all hydrocarbon exploration activities. Hydrocarbon exploration and production in Senegal were regulated by law No. 98-05 of January 5, 1998 (Société des Petroles du Senegal, 1998§). Companies that were exploring for oil in 2001 were Roc Oil Ltd. of Australia, Shell Exploration of the United Kingdom, Vanco Energy Co. of the United States, and Woodside Petroleum Ltd. of Australia. In November 2001, PETROSEN was expected to pursue a major onshore seismic oil program that would cover northeastern Senegal with the help of a $65 million loan from the World Bank (Africa Energy Intelligence, 2001b).

In March, Fortesa International plc. of the United States signed a production-sharing agreement with PETROSEN for the Thies gas permit. The permit comprises 1 million acres along the western coast of Senegal. The agreement granted Fortesa a 7-year exploration period; Fortesa was expected to invest $16.3 million on collecting data, drilling wells, and constructing a pipeline (Alexander's Gas & Oil Connections, 2001§). The country's natural gas reserves, which were estimated to be 3 billion cubic meters, were located primarily onshore (MBendi Information Service (Pty.) Ltd., 2000§).

Senegal's petroleum refining company, Société Africaine de Raffinage, which was located in Dakar, processed about 770,000 t/yr of imported crude oil. The refinery's capacity was about 1 Mt/yr of oil (MBendi Information Services (Pty.) Ltd., 2000§).

Digitized by Google

In 2000, Senegal signed a memorandum of understanding with 13 countries for the establishment of the West African power pool, which will be created in two phases and fully implemented by 2005 (Guardian, 2000§).

In November, the struggle to privatize Senegal's state-owned Societe Nationale d'Electricite, which was responsible for generating, transmitting, and distributing the majority of Senegal's electricity, ended with the acceptance of a bid from Vivendi of France. Vivendi was also involved with utilities in Niger and was seeking energy investment opportunities in Mauritania (Africa Energy Intelligence, 2001c).

In July, the African Development Bank Group approved a $18.68 million loan to help finance the 148-km Diamniadio-Mbour-Kaolack road project in Senegal. The loan only represented 60% of the total cost of the project, which was estimated to be $33.38 million. The 25-month project wais expected to rehabilitate the existing road and revitalize economic growth in the region (African Development Bank Group, 2001b§).

References Cited

Africa Energy Intelligence, 2001a, Petrobank—Partnership with Premier Oil in Guinea Bissau: Africa Energy Intelligence, no. 302, July 4, p. 2.

Africa Energy Intelligence, 2001b, Senegal—Exploration starts in earnest: Africa Energy Intelligence, no. 311, November 28, p. 4.

Africa Energy Intelligence, 2001c, Senegal—Last-minute win for Vivendi: Africa Energy Intelligence, no. 311, November 28, p. 6.

African Mining Bulletin, 2001, Guinea Bissau—Champion starts exploration program: Africa Mining Bulletin, no. 141, May 4, p. 2.

Africa Mining Intelligence, 2001, Gambia—Zircon: Resources underestimated: Africa Mining Intelligence, no. 15, May 30, p. 3.

Craig, Rod, 2000, Senegal, *in* Special report: Washington Times September 7, 4 p.

Industrial Minerals, 2001, Farim talks breakdown: Industrial Minerals, no. 403, April, p. 77.

Mining Journal, 2000, Senegal, in Mining annual review 2000: London, United Kingdom, Mining Journal Ltd. CD-ROM.

Mining Journal, 2001, Senegalese convention for Randgold: Mining Journal Ltd., v. 337, no. 8661, November 23, p. 396.

Resource Information Unit, 2002, Register of African mining 2001/2002: Subiaco, Australia, Resource Information Unit, 350 p.

Internet References Cited

African Development Bank Group, 2001a (March 1), The African Development Fund approves a $1.21 million grant to finance the Boke-Quebo multinational road study (Guinea/Guinea-Bissau), accessed May 10, 2002, at URL http://www.afdb.org/knowledge/loans2001/ BokeQuebo_Guinea.htm.

African Development Bank Group, 2001b (July 12), The African Development Fund approves a $18.68 million loan to finance the Diamniadio-Mbour-Kaolack road project in Senegal, accessed June 7, 2002, at URL http://www.afdb.org/knowledge/pressreleases2001/adf_50_2001e.htm.

African Development Bank Group, 2001c (September 13), The African Development Fund approves a $12.35 million loan to finance the coastal protection project in the Gambia, accessed May 29, 2002, at URL http://www.afdb.org/knowledge/pressreleases2001/adf_58_2001e.htm.

Alexander's Gas and Oil Connections, 2001 (April 2), Senegal and Fortesa sign hydrocarbon prospect contract, accessed June 6, 2002, at URL http://www.gasandoil.com/goc/company/cna11095.htm.

Carnegie Corp. Ltd., [undated], The Gambia—West Africa mineral sands, Operations, accessed May 29, 2002, at URL http://www.carnegiecorp.com.au/thegambia2001.html.

Direction des Mines et de la Geologie, 2000a, Gold of Sabodala, accessed May 25, 2001, at URL http://www.energie.gouv.sn/DMG/Framdmg.htm.

Direction des Mines et de la Geologie, 2000b, MIFERSO, accessed May 25, 2001, at URL http://www.energie.gouv.sn/DMG/miferso.htm.

F.L.Smidth Group, 2001 (March 21), F.L.Smidth wins 30m euro contract in Senegal, accessed October 25, 2001, at URL http://www.flsmidth.dk/news/c72.htm.

Guardian, 2000 (October 6), 13 ECOWAS states sign energy pact, accessed October 6, 2000, at URL http://www.ngrguardiannews.com/news2/nn799303.html.

International Monetary Fund, 2002 (April), The world economic outlook database, accessed June 12, 2002, at URL http://www.imf.org/external/pubs/ft/weo/2002/01/data.

MBendi Information Services (Pty.) Ltd., 2000 (September 29), Senegal oil and gas industry, accessed November 28, 2000, at URL http://mbendi.co.za/indy/oilg/af/sn/p0005.htm.

MBendi Information Services (Pty.) Ltd., 2001 (March 6), The Gambia—Mining, accessed May 24, 2002, at URL http://www.mbendi.co.za/indy/ming/af/gm/p0005.htm.

Société des Petroles du Senegal, 1998, Petroleum legislation, accessed June 14, 2001, at URL http://www.petrosen.com/legal.htm.

U.S. Department of State, 2001 (July), Dakar, Senegal, Country Commercial Guide, accessed October 31, 2001, at URL http://www.dakarcom.com/CCG/ccg2001.htm.

World Bank, 2001a (September 18), Guinea Bissau at a glance, 2000, accessed February 22, 2002, via URL http://www.worldbank.org/data/countrydata/countrydata.html#AAG.

World Bank, 2001b (September 21), Senegal at a glance, 2000, accessed February 22, 2002, via URL http://www.worldbank.org/data/countrydata/countrydata.html#AAG.

World Bank, 2001c (September 26), The Gambia at a glance, 2000, accessed February 22, 2002, via URL http://www.worldbank.org/data/countrydata/countrydata.html#AAG.

Major Sources of Information

Ministry of Natural Resources and the Environment
5 Marina Parade
Banjul, Gambia
Telephone: 220-22-8702
Fax: 220-22-8628

Ministry of Trade, Industry, and Employment
Independence Drive
Banjul, Gambia
Telephone: 220-22-8332
Fax: 220-22-9220

Ministry of Natural Resources and Energy
P.O. Box 399
Bissau, Guinea-Bissau
Telephone: 245-22-3149
Fax: 245-22-1924

State Commissioner of Natural Resources
Bissau Codex
Bissau, Guinea-Bissau

Direction des Mines et de la Geologie
BP 1238
Dakar, Senegal
Telephone: 221-32-07-26
Fax: 221-32-08-52

Digitized by Google

TABLE 1
THE GAMBIA AND SENEGAL: ESTIMATED PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Thousand metric tons unless otherwise specified)

	1997	1998	1999	2000	2001
THE GAMBIA 3/					
Clay metric tons	1,200 4/	1,200	1,520 r/ 4/	1,960 r/ 4/	2,000
Silica sand	303 4/	270 4/	173 r/ 4/	170 r/ 4/	170
SENEGAL 5/					
Cement, hydraulic	854 4/	1,000	1,000 4/	1,000 4/	1,000
Clays, fuller's earth (attapulgite)	80	80	136 4/	131 4/	130
Gold 6/ kilograms	550	550	550	550	550
Petroleum:					
Natural gas thousand cubic meters	56,000	56,000	56,000	56,000	56,000
Crude oil thousand 42-gallon barrels	1	1	1	1	1
Refinery products do.	6,000	6,000	6,000	6,000	6,000
Phosphate rock and related products:					
Calcium phosphate-based fertilizers	160	160	160 4/	160 4/	160
Crude rock:					
Aluminum phosphate	20	20	31 4/	182 4/	190
Calcium phosphate	1,565 4/	1,478 4/	2,000 4/	2,000 4/	1,700
Phosphoric acid	300	300	300 4/	300 4/	300
Salt	120	139	130 4/	130 4/	130

r/ Revised.
1/ Estimated data are rounded to no more than three significant digits.
2/ Includes data available through June 2002.
3/ In addition to the commodities listed, The Gambia also produced a variety of construction materials (laterite, sand, and shell), but information is inadequate to make reliable estimates of output levels.
4/ Reported figure.
5/ In addition to the commodities listed, Senegal also produced clays, sand and gravel, and stone for local construction purposes, and limestone for cement, but information is inadequate to make reliable estimates of output levels.
6/ Government estimate of unreported production of artisinal gold.

TABLE 2
SENEGAL: STRUCTURE OF THE MINERAL INDUSTRY IN 2001

(Thousand metric tons)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement	Les Ciments du Sahel S.A. of Senegal (private, 100%)	Kirène plant	600
Do.	Société Ouest Africaine des Ciments (private, 100%)	Rufisque plant	1,600
Phosphate	Compagnie Senegalaise des Phosphates de Taiba (Government, 100%)	Taiba mine	2,000
Petroleum products	Société Africaine de Raffinage (private, 100%)	Dakar refinery	1,000

Digitized by Google

THE MINERAL INDUSTRY OF

GHANA

By George J. Coakley

The Republic of Ghana covers an area of 238,540 square kilometers within West Africa and supported a population of around 19.9 million in mid-2001. During 2001, the economy continued to be affected by a high level of indebtedness, a high rate of inflation, weak international prices for its major exports (cocoa, gold, and timber), and high international prices for its major imports of petroleum products, chiefly diesel fuel for the mining sector. Ghana was the second largest gold producer in Africa after South Africa, the third largest African producer of aluminum metal and manganese ore, and a significant producer of bauxite and diamond. Production of major mineral commodities is listed in table 1. In addition, a number of industrial minerals, which included clays (kaolin), dimension stone, limestone, salt, sand and gravel, and silica sand, were produced on a small scale (Barning, 1997, p. 1).

The Ghana Ministry of Finance reported that the real gross domestic product (GDP) grew at a rate of 4.0% in 2001 compared with 3.7% in 2000; inflation declined to 25% from 40% in 2000; the Ghanaian cedi (C) leveled off at an average rate of C7,062 to the dollar for 2001 after having depreciated by more than 160% against the U.S. dollar from its 1999 average to the end of 2000. Ghana's external debt totaled $6.2 billion; during 2001, the Government applied for relief under the World Bank's Heavily Indebted Poor Countries initiative. For 2001, the country had an $800 million merchandise trade deficit, which was based on total exports of $1.98 billion and total imports of $2.78 billion. The principal exports were gold ($634.4 million), cocoa ($378 million), and timber ($169.2 million). Gold export revenues, which were based on an average price of $273 per troy ounce of gold for 2001, declined by 21% from those of 2000 but were forecast to increase significantly in 2002 as the world gold price moved up to the $300- to $325-per-ounce range in early 2002 (Ghana Ministry of Finance, 2002§[1]).

Other mineral commodity exports in 2001 included manganese ($25.2 million), diamond ($18.5 million), and bauxite ($12.7 million). Ghana's main processed mineral commodity export was primary aluminum, which was toll-refined by Volta Aluminum Co. Ltd. (Valco) from imported alumina. On the basis of the average price of aluminum of $1.54 per kilogram ($0.70 per pound) in 2001, aluminum production of 162,000 metric tons (t), most of which was exported, was valued at about $249 million. Petroleum imports were valued at $550 million and accounted for 18% of total merchandise imports during 2000. Other mineral- or mining-related imports included alumina for aluminum production; clinker, gypsum, and limestone for cement production; fertilizers; and sodium cyanide for gold leaching.

[1]References that include a section twist (§) are found in the Internet References Cited section.

Government Policies and Programs

Legislation that affects mining and mineral exploration in Ghana includes the Minerals and Mining Law, 1986 (PNDCL 153), as amended by the Minerals and Mining (Amendment) Act, 1994 (Act 475); the Additional Profits Tax Law, 1985 (PNDCL 122); the Minerals Commission Law, 1986 (PNDCL 154); and the Minerals (Royalties) Regulations, 1987 (LI 1349). The 1986 mining law had been instrumental in attracting more than $4 billion in foreign investment to the Ghanaian mining industry through the end of 2000. Act 475 has reduced the 45% general mining corporate tax rate to 35%, which is the same as that imposed on other industries. The Petroleum (Exploration and Production) Law, 1984 (PNDCL 84), sets out the policy framework and describes the role of institutional participants, namely the Ministry of Mines and Energy, which regulates the industry. Ghana National Petroleum Corp. (GNPC), which is empowered to undertake petroleum exploration and production on behalf of the Government, is authorized to enter joint ventures and production-sharing agreements with commercial organizations; GNPC was established under the GNPC Law of 1983 (PNDCL 64). The regulation of artisanal gold mining is set forth in the Small-Scale Gold Mining Law, 1989 (PNDCL 218). The Precious Minerals Marketing Corporation Law, 1989 (PNDCL 219), set up the Precious Minerals Marketing Corp. (PMMC) to promote the development of small-scale gold and diamond mining in Ghana and to purchase the output of such mining either directly or through licensed buyers. Concerned with the dropoff in investment in the mining sector since 1999, the Ministry of Mines was preparing draft legislation, which will be submitted to Parliament in mid-2002, to revise PNDCL 153 to enhance Ghana's international competitiveness.

The Ministry of Mines and Energy oversees all aspects of the Ghanaian mineral economy and is the grantor of mineral and energy exploration and mining leases. Within the Ministry, the Minerals Commission has responsibility for administering the Mining Act, recommending mineral policy, promoting mineral development, advising the Government on mineral matters, and serving as a liaison between industry and the Government. The Ghana Geological Survey Department conducts geologic studies, and the Mines Department has authority in mine safety matters. All mine accidents and other safety problems also must be reported to the Ghana Chamber of Mines, which is the

Digitized by Google

private association of operating mining companies. The Chamber also provides information on Ghana's mining laws to the public and negotiates with the mine labor unions on behalf of its member companies.

Structure of the Mineral Industry

Through privatization programs during the 1990s, the Government greatly reduced its once-dominant stake in cement and gold companies. It has maintained a controlling interest in Ghana Consolidated Diamonds Ltd., GNPC, and state-run Tema Steel Co.

Efforts to attract foreign investment in recent years have brought in a wide range of companies from Australia, Canada, Ireland, South Africa, the United Kingdom, and the United States, which held controlling interests in most of the mines in Ghana (table 2). Chiefly owing to weak gold markets, new investment in the foreign mining sector was limited in 2000 and 2001. Kaiser Aluminum & Chemical Corp. (Kaiser) of the United States maintained its longstanding 90% interest in the Valco aluminum smelter and was the major consumer of hydroelectric power generated by the state-owned Volta River Authority (VRA).

Commodity Review

Metals

Aluminum and Bauxite. —Valco's smelter at Tema Harbor was majority owned and operated by Kaiser (a wholly owned subsidiary of Kaiser Aluminum Corp.). Valco continued to deal with fluctuating operating levels, which resulted from the amount of power that it has been allocated by the VRA under a contract agreement that is valid until 2017. VRA power allocations have been restricted by droughts and low water levels in the Akosombo Dam. During 2000 and 2001, Valco operated an average of four potlines, or at an average 81% of capacity. Each potline represented approximately 20% of the plant's 200,000-metric-ton-per-year (t/yr) aluminum capacity. Owing to power shortages, Valco expected to operate only three potlines during 2002. In late 2000, Valco and the VRA reached an agreement that would provide for sufficient power to operate at least four of Valco's five potlines in 2001 and at least three and one-half potlines thereafter. By March 2002, however, the Parliament had yet to approve the agreement, and Kaiser was going to seek remedies from the Government. In its 2001 annual report, Kaiser announced that it filed for voluntary bankruptcy in U.S. courts because of liquidity and cash flow problems in late 2000 and early 2001. The company stated, however, that they did not expect the Valco operations to be affected because it had received authority from the bankruptcy court to fund Valco's cash requirements in the ordinary course of business (Kaiser Aluminum & Chemical Corp., 2002§).

Ghana Bauxite Co. Ltd. (GBC), which was majority owned by Alcan Aluminum Ltd. of Canada, operated the country's only bauxite mine at Awaso, which has been in production since 1941. As a result of recent investment and equipment upgrading in 2001, GBC increased production by 42% to 715,455 t/yr of salable bauxite.

Gold—Of the 11 major gold mines in operation in Ghana in 2001, the 5 largest accounted for a total of nearly 83% of the recorded gold output of the country—Obuasi (24%), Tarkwa (24%), Damang (13.8%), Bibiani (11.5%), and the combined Iduapriem/Teberebie Mine (9.3%). Gold production, by mine, from 1997 to 2001 is listed in table 3.

In 2001, Ashanti Goldfields Co. Ltd.'s corporate gold production from six mines in Ghana, Guinea, Tanzania, and Zimbabwe totaled 49,253 kilograms (kg), of which approximately 62% was from operations in Ghana compared with 66% in 2000. The decline of Ghana's total share in Ashanti's production was due to the closure of the high-cost Obuasi surface mining and leaching operations in Ghana, the opening of its 50% owned Geita Mine in Tanzania during 2000, and the closure of the Ayanfuri Mine in Ghana in 2001. Ashanti's liquidity position improved in 2001 as it continued to restructure and pay down its debt that resulted from large hedging losses in late 1999. During 2001, outstanding debt was reduced to $325.9 million from $365.7 million in 2000. In January 2002, the company announced plans to restructure $218.6 million in debt by refinancing $164 million in loans and by converting nearly $55 million to equity through the issuance of new shares. Combined with the increased cash flow from the Geita Mine, the company was returning to profitability (Ashanti Goldfields Co. Ltd., 2002, p. 18).

Production decreased by 7.5% at Ashanti's Bibiani Mine and by 18% at the Obuasi Mine following shutdown of surface operations at the latter in 2000. Exploration at the Obuasi Mine during 2001 intersected high-grade gold mineralization that included sections which assayed from 20 to 66 grams per metric ton (g/t) gold below the 1,520-meter (5,000-foot) level; this suggested the significant potential of the mine, which has been in production since 1897. With the acquisition of additional ore reserves from the Teberebie Mine, Ashanti increased the life expectancy of the Iduapriem Mine and increased production in 2001 by 23% to 6,380 kilograms per year (kg/yr) of gold. Ashanti announced plans to expand the capacity at Iduapriem/Teberebie during 2002 by upgrading the carbon-in-leach (CIL) plant to treat 4 million metric tons per year (Mt/yr) of ore from its present capacity of 2.9 Mt/yr of ore.

The expansion project will include a new semiautogenous grinding (SAG) mill, the conversion from CIL to carbon-in-pulp (CIP), and installation of a new primary crusher and overland ore conveyor from the Teberebie pits. At Bibiani, ore grades continued to exceed the reserve model. Metallurgical recovery, however, decreased to 83.7% from 86.7% in 2000 as more refractory ore was treated. A feasibility study was being conducted to evaluate the possible development of a trackless underground mine to access deeper ore resources at Bibiani. During 2001, a small deposit at Mpesetia was acquired that contained 933 kg of gold reserves, which will be trucked to Bibiani for treatment. At the end of 2001, Ashanti reported measured and indicated resources of 206.6 million metric tons (Mt) at an average grade of 4.2 g/t gold, of which underground

Digitized by Google

measured and indicated resources at Obuasi accounted for 57.3 Mt at a grade of 10.1 g/t gold, at its four mines in Ghana. The total reported measured and indicated resources estimates represented more than 867 t, or nearly 28 million ounces of contained gold. As of December 31, 2001, reported proved and probable ore reserves at its four mines in Ghana were 114.8 Mt at an average grade of 4.18 g/t gold, of which underground proved and probable reserves at Obuasi accounted for 42.3 Mt at a grade of 8.0 g/t gold (Ashanti Goldfields Co. Ltd., 2002, p. 22).

On the basis of Gold Fields Ltd. quarterly reports for calendar year 2001, the Tarkwa open pit heap-leach operation mine processed 14.55 Mt of ore that yielded an average of 1.13 g/t gold and a total of 16,393 kg of gold compared with 11,272 kg of gold for calendar year 2000. This 45% increase in production was attributed, in part, to the integration of Teberebie crushing and heap leach assets into Tarkwa operations during 2001 (Gold Fields Ltd., 2002§).

Gold Fields reported the following resources and reserves at its Tarkwa Mine, as of June 30, 2001, based on a gold price of $285 per troy ounce and a cutoff grade of 0.5 g/t gold and including the recently acquired Teberebie resources. Near-surface measured, indicated, and inferred resources above a cutoff grade of 5 g/t gold at Tarkwa were estimated to be 340.4 Mt of ore at an average grade of 1.6 g/t gold for a total resource of 530,840 kg of contained gold, of which proven and probable reserves were estimated to be 131.2 Mt at an average grade of 1.6 g/t gold for a total resource of 213,430 kg of contained gold (Gold Fields Ltd., 2001§).

In January 2002, Gold Fields completed the purchase of 90% of Abosso Goldfields Ltd. and its adjacent Damang Mine from Ranger Minerals Ltd. of Australia for approximately $31 million and 4 million shares of Repadre Capital Corp. of Canada stock, which was valued at $3.40 (Canadian) per share at the time of the agreement. The acquisition will add an additional 7,776 kg/yr of gold to Gold Fields' production capacity. The ownership of Gold Fields (Ghana) Ltd. and Abosso will be Gold Fields Ltd. of South Africa, 71.1%; Repadre, 18.9%, and the Government, 10%. As of June 30, 2001, Damang had resources of about 94,000 kg (3.03 million ounces) and reserves of about 47,000 kg (1.53 million ounces). Gold Fields planned a detailed exploration of the area between the two mines (Gold Fields Limited-Repadre Capital Corporation, 2002).

Production shown in table 3 for Damang was for calendar years 1998 to 2001. For Ranger Minerals' financial year that ended June 30, 2001, however, Abosso had milled 4.54 Mt of ore at an average grade of 2.42 g/t gold to yield 10,017 kg of gold on the basis of a 91.2% recovery rate. The 7% decrease in gold output from that of the 2000 financial year was attributed to a 2-week shutdown of the mill for maintenance. Revised mineral resources estimates as of June 30, 2001, which were based on a cutoff grade of 1.1 g/t for primary ore and 0.5 g/t for oxide ore was 41.6 Mt at an average grade of 2.26 g/t gold. The measured and indicated component of the mineral resource was estimated to be 30 Mt at an average grade of 2.23 g/t gold. Additional material that might be added to the identified resources had been located at several nearby deposits, such as the Kesi-Lima pits and the Rex prospect and in the Tomento-Amoanda areas. Pit optimization studies for the Damang resource, which were based on a gold price of $300 per ounce, projected an end of mining in 2006, with completion of processing of then-remaining stockpiles 2 years later (Ranger Minerals Ltd., 2001).

Resolute Amansie Ltd., which was owned by Resolute Ltd. of Australia, operated the Obotan gold mine and CIL plant. Obotan is located near Manso-Nkran, which is 47 kilometers (km) west of Obuasi. With the depletion of near-surface oxide ore at the Adubiaso Hill section of the mine, Resolute Amansie installed a new secondary/tertiary crusher to treat harder primary ore found during 2000. With the operations main ore source at the Nkran pit nearing completion and the satellite deposit at Adubiaso proving erratic, gold production at Obaton for calendar year 2001 was 3,447 kg; this was a decrease of 19% from that of 2000 (Resolute Ltd., 2001).

In July 2001, Resolute agreed to purchase Abore Mining Company Limited (AMC) from Leo Shield Exploration Ghana Ltd. of Australia for "$2.5 million cash payable on settlement plus an additional amount related to gold production from the Abore Mine of $7.50 per ounce on gold produced, plus 25% of the amount by which the average spot price of gold per ounce for a month exceeds $265 for the number of ounces produced in that month." The Abore gold deposit, which is located about 20 km north of Resolute's Obotan Mine, had a proved and probable reserve of 2.26 Mt at a grade of 1.9 g/t gold as of March 2000. Resolute intended to begin mining at Abore immediately and to treat the ore at its Obotan Mill. This will deliver an expected 3,110 kg/yr of production and extend the life of operations at Obotan by approximately 12 months (Resolute Ltd., 2001).

Satellite Goldfields Ltd., which was owned by Glencar Mining plc. of Ireland through its Wassa Holdings Ltd. subsidiary, operated the Wassa gold open pit heap-leach project, which is about 35 km northeast of Tarkwa. In February 2001, the company announced plans to sell the mine as a going concern. Following poor metallurgical gold recovery from its heap-leach operations since the Wassa project was commissioned in 1999, recoveries in late 2000 and early 2001 began reaching levels projected at the time of the initial capital investment on a relatively consistent basis. The accumulated shortfall in production together with the continuing low gold price, however, meant that the project was unable to meet all its current scheduled debt repayments. Mining operations continued at reduced levels at Wassa until the end of October 2001 when they were suspended. Stacking of stockpiled ore was completed by the end of that month, and the operation has continued on a leaching only basis at the mine since then. During the first 10 months of the year, 2.1 Mt of ore at an average grade of 1.6 g/t was stacked. Gold production for 2001 was more than 2,182 kg of gold. In November 2001, Glencar announced that subject to completion of its due diligence and arrangement of finances, Golden Star Resources Ltd. of the United States would purchase the Wassa Mine. Golden Star intended to replace the leaching pads with a CIL plant to improve metallurgical recoveries. The sale was expected to be completed in July 2002 (Glencar Mining plc, 2002, p. 3-5).

During 2001, in addition to its proposed acquisition of the Wassa Mine, Golden Star continued to consolidate its resource position along the Ashanti structural trend. It increased its

Digitized by Google

interest in Bogosu Gold Ltd. (BGL) to 90% from 70% by buying out its minority partner Anvil Mining NL of Australia. BGL operated the Bogosu Mine and CIL plant, which were located between Dunkwa and Prestea. In May 2001, Golden Star acquired the surface rights to the Prestea area from Prestea Gold Resources Ltd. (PGR) and Barnato Exploration Ltd. (Barnex) of South Africa. Initially, BGL was to acquire the surface mining rights and a 35% interest in PGR from PGR for a payment of $4 million. In March 2002, however, the agreement was restructured as a joint venture between BGL and PGR, with BGL increasing its interest in PGR to 45% for an additional $0.5 million payment. PGR retained its rights to the old Prestea underground mine below a depth of 200 m. On June 29, 2001, the Government granted Golden Star a new 30-year mining lease that covered surface mining rights in the Prestea area, which was adjacent and to the southwest of the Bogosu Mine. In September, surface mining at the Bueschem deposit, which is located in the northern part of the Prestea area, began. Ore will be shipped to the Bogosu CIL plant for processing. In a separate agreement with Barnex, Golden Star acquired its option to the Prestea property in exchange for Golden Star shares that were valued at about $3.3 million and payment to Barnex of a royalty of $6.00 to $16.80 per ounce, tied to the prevailing gold price, on the first 3,110 kg (1 million ounces) of gold produced at the Bogosu/Prestea operation. Oxide reserves at the known Prestea surface deposits were sufficient to supply ore to the Bogosu CIL plant through 2006. Following that, BGL was looking into a $30 million investment to install a bio-oxidation (BIOX) plant to treat sulfide ore reserves. As of December 31, 2001, measured and indicated mineral resources for the combined Bogosu/Prestea property were 28.5 Mt at a grade of 3.14 g/t gold, of which probable mineral reserves were 19.1 Mt at grade of 2.97 g/t. Of the 89,375 kg of gold contained in the mineral resources, approximately 18% was in oxide and transitional ores and the remainder in primary and refractory ores (Golden Star Resources Ltd., 2002, p. 4-7).

Akrokeri-Ashanti Gold Mines Inc. (AAGM) of Canada owned 85% of Bonte Gold Mines Limited and 90% of Jeni Gold Mining Limited; both were Ghanaian subsidiaries. Gold was produced from alluvial mining of old flood plain and terrace sediments. Bonte's Esaase deposit was mined out by 1997, and operations shifted to the Jeni River property. During 2001, production by Bonte decreased slightly by 4% to 2,031 kg of gold as a result of an unexpected loss of fine-grained gold fractions in the sluice system. Extensive testing of Bonte Mine's processing plant indicated that a combination of Knelson concentrators and cyclones would solve the fine-grained gold recovery problem. The new concentrators were expected to be commissioned in April 2002, and completion of the cyclone upgrade was completed by June 2002. As of December 31, 2000, the Bonte reserves consisted of 2.8 million cubic meters of proven reserves that contained 3,255 kg of gold and 4.7 million cubic meters of probable reserves that contained 3,942 kg of gold. Bonte continued to evaluate the economic potential of 4 million cubic meters of gold-bearing gravels identified at the Jeni property during 2000 (Akrokeri-Ashanti Gold Mines, Inc., 2002a§).

In early 2000, AAGM completed its acquisition of a 90% interest in the Goldenrae Mining Company. The Goldenrae deposit, which is located west of Kibi, was mined for 15 months in the early 1990s and then closed. The Goldenrae property had two mining leases and a fully operational floating processing plant with the capacity to produce 780 kg/yr of gold. The two Goldenrae leases contain a stated proven and probable reserve estimated to be 4,043 kg of gold. An adjacent prospecting license for which AAGM has been granted an option has a stated reserve of 2,177 kg of gold. AAGM was evaluating the potential for reopening operations at Goldenrae during 2002 (Akrokeri-Ashanti Gold Mines, Inc., 2002b§).

In a major acquisition, Newmont Mining Corp. of the United States announced in November 2001 its plans to acquire Normandy Mining Ltd. of Australia and Franco-Nevada Mining Corp. Ltd. of Canada, which held a 20% interest in Normandy. The resulting company will be the largest gold producer [248,830 kg/yr (8 million ounces per year)] and holder of gold reserves [301,700 kg (97 million ounces)] in the world (Newmont Mining Corp., 2001). The acquisition was completed in February 2002. Its major holding in Ghana was Normandy's Yamfo-Sefwi project, which was located in the Yamfo-Sefwi greenstone belt in west-central Ghana near Sunyani and Kenyasi about 60 km east of the border with Côte d'Ivoire. Newmont lumped Yamfi-Sefwi mineral resources in the "other" category in its 2001 annual report. As of June 30, 2000, however, Normandy had reported mineral resources to be 42.2 Mt of measured resources at a grade of 2.3 g/t gold, 16.8 Mt of indicated resources at a grade of 2.2 g/t gold, and 16.7 Mt of inferred resources at a grade of 2.0 g/t gold. Normandy also held a 42.3% joint-venture interest in Moydow Mines International Inc.'s adjacent Area E (Ntotoroso) property where inferred resources were reported to be 14 Mt at a grade of 2.6 g/t gold. The two deposits have a combined gold content of 205,600 kg (6.61 million ounces). Normandy's 2000 feasibility study on the Yamfo-Sefwi project estimated that capital costs of $152 million would be required to develop 15 pits at Bosumkese, Kenyase, Subenso, and Yamfo and a treatment plant with an initial capacity of 3.5 Mt/yr, which would process oxide (40%) and sulfide (60%) ore. The plant flowsheet incorporated primary crushing, SAG, and ball milling followed by a CIL circuit. A feasibility study to incorporate Moydow's Ntotoroso deposit, which was based on toll processing of Ntotoroso ore at the Yamfo-Sefwi treatment plant and an increase in plant capacity to 5 Mt/yr of ore, was expected to be completed by mid-2001 (Normandy Mining Ltd., 2000, p. 15-17). In July 2001, Rank Mining Ltd., which was a 50-50 joint venture between Normandy and Moydow, was granted a 30-year Mining License on the Ntotoroso project (Moydow Mines International Inc., 2001). In its report for the third quarter of 2001, Moydow indicated that it would defer any decision on the development of these properties until the Newmont takeover of Normandy was completed.

Chirano Gold Mining Ltd., which was owned by Red Back Mining NL of Australia (95%), continued exploration drilling and feasibility studies during 2001 at its Chirano property, which was adjacent to the GBC bauxite mine at Awaso. In early 2001, Ashanti made an offer to buy Chirano, which was rejected by Red Back as too low. Ashanti was seeking the

Digitized by Google

Chirano ore as feed for its nearby Bibiani plant, which is located 17 km to the north; the plant will run out of mine feed in late 2003. Subject to locating stand-alone financing or negotiating a better offer from Ashanti, Red Back concentrated on expanding the gold resource base with further exploration at Chirano in 2001. Revised indicated mineral resources, which were based on a 1-g/t cutoff, a gold price of $300 per ounce, and a 92% recovery, were reported to be 15.8 Mt at a grade of 2.3 g/t gold in seven prospects along 4 km of the Chirano Shear Zone at Akota North, Akota South, Obra, Paboase, Sariehu, Suraw, and Tano. Additional inferred mineral resources were estimated to be 5.66 Mt at a grade of 2.1 g/t gold. A 2001 prefeasibilty study indicated a potential for developing a small project that would produce 3,515 kg/yr for 6.6 years at a capital cost of $32 million (Red Back Mining NL, 2002, p. 4).

In other gold exploration activity, the Canadian joint venture of St. Jude Resources Ltd. and Fairstar Explorations Inc. continued work on its Hwini-Butre and South Benso concessions. The Hwini-Butre concession had a reported indicated mineral resource of 4.25 Mt at a grade of 4.11 g/t gold and an inferred mineral resource of 1.72 Mt at a grade of 3.01 g/t gold. Gold mineralization has been at the adjacent South Benso Concession, and further exploration will be conducted on this property during 2002 (St. Jude Resources Ltd., 2002, p. 10). Marine Mining Corp., which was a Canadian junior exploration company, held a 10,000-square-kilometer marine concession offshore for precious metal, industrial mineral and aggregate exploration. The 240-km-long by 40-km-wide concession runs approximately from Winneba to just past Axim and covers the offshore extensions of the Ashanti and the Kibi-Winneba structural belts and their drainage systems.

Manganese.—Ghana Manganese Company Limited's Nsuta-Wassaw open pit mine near Tarkwa was the only producer of manganese ore in Ghana. During 2001, production of manganese ore decreased by 9% to 813,329 t of manganese ore from 895,669 t in 2000 (table 1). The metal content of the manganese carbonate ore was between 32% and 34% manganese. Reinvestment in new equipment and rehabilitation of the export railroad from Nsuta to Takoradi Harbor have allowed the company to double manganese exports since 1997.

Industrial Minerals

Cement.—Ghana Cement Works Ltd. (Ghacem) operated the country's only two clinker grinding plants at the port cities of Takoradi and Tema. Each plant had the capacity to produce 1.2 Mt/yr of cement by using imported clinker, gypsum, and limestone. During 1999, Heidelberg Zement AG of Germany acquired a 94.5% interest in Ghacem from Scancem International AG of Norway (60%) and the Government. The company operated essentially as a monopoly but has faced increasing competition from cement imports from Togo since 1999. During 2000 and 2001, Ghacem operated at about 80% of capacity. The mining industry accounts for about 10% of cement consumption, chiefly as a binder in gold heap-leach pads and CIL plants.

Diamond.—The majority of diamond was recovered by artisanal miners from alluvial and raised terrace gravel workings in the Birim Valley. On the basis of sales to the Precious Metals Marketing Corporation in 2001, artisanal output was reported to be 870,490 carats with an average sales value of $21.26 per carat. Production from Ghana Consolidated Diamonds Ltd.'s Akwatia placer diamond mine was not available in 2001. Akwatia is located about halfway between Accra and Kumasi and was the only formal operating diamond mine in Ghana.

Other Industrial Minerals.—Carmeuse Lime Products (Ghana) Ltd., which was owned by Carmeuse S.A. of Belgium, operated out of Sekondi and produced limestone and lime, as well as seashells, which were supplied to Ashanti for use in its BIOX gold-treatment plant at Obuasi. An estimated 20,000 to 30,000 people were involved in the small-scale production of industrial minerals, which included kaolin, limestone, salt, and sand and gravel.

Mineral Fuels

In 2001, GNPC produced an estimated 9,000 barrels per day (bbl/d) of crude oil from the Saltpond and the Tano oilfields. On the basis of exploration during the past 30 years, the offshore fossil fuel potential was the greatest for natural gas; no gas, however, was being produced. Several companies, which included Hunt Oil Co. of the United States in the Cape Three Points Southwest deepwater block and Nuevo Energy Co. of the United States (75%) and SK Corp. of Korea (25%) in the Cape Three Points East block and the Accra-Keta block, were exploring for offshore oil and gas during 2001. In July 2001, Nuevo abandoned its exploration well and relinquished its Accra-Keta block. Dana Petroleum plc of the United Kingdom held the rights to the Cape Three Points West block and the West Tano Contract Area. Dana announced the discovery of oil with a flow rate of 1,000 bbl/d on the West Tano Contract Area in March 2000 and was evaluating its commercial development potential during 2001. Other U.S. companies that were active in offshore exploration included Devon Energy Corp. in the offshore Volta River block and Andarko Petroleum Corp. in the Keta block. GNPC announced its plans for the Tano Fields Development and Power Project, which would add about 260 megawatts of additional electric power generation capacity fueled by offshore natural gas resources; this would be accomplished by developing the Tano gasfields and distribution infrastructure at a cost of up to $500 million (U.S. Energy Information Administration, 2001§).

Ghana's only petroleum-refining facility was the 45,000-bbl/d Tema oil refinery that is located outside of Accra. It was operated by Tema Oil Refinery (TOR) (a subsidiary of GNPC). The company primarily processed imported Bonny Light/Brass River crudes from Nigeria and produced a variety of refined products for domestic consumption and export. Unfavorable exchange rates and increased petroleum prices and imports weakened the ability of TOR to import oil. By March, its debt had increased to $350 million, which presented another economic problem to the newly elected Government (U.S. Energy Information Administration, 2001§).

In a major example of West African regional cooperation and coordinated economic planning, a plan was approved in August

Digitized by Google

1999 to construct the West Africa Gas Pipeline (WAGP), which would use Nigerian natural gas that has been flared to help solve the long-term energy needs of the neighboring states of Benin, Ghana, and Togo. By using Nigeria's more than 1.1 trillion cubic meters of natural gas reserves, a consortium led by Chevron Nigeria Ltd. committed to build the WAPG by 2002. The $400 million project will involve the construction of an 800-km offshore gas pipeline from the Niger Delta to the west coast city of Effuasi, Ghana. The pipeline will supply an initial amount of 120 million cubic feet per day of gas to existing and planned powerplants in Benin, Ghana, and Togo. Cooperators in the WAGP Project included Nigerian National Petroleum Corporation, GNPC, Shell Petroleum Development Company, Société Togolese de Gaz, and SA Société Béninoise de Gaz (Chevron Nigeria Ltd., 1999§). Construction of the WAGP, which was originally scheduled to begin in 2001, has been delayed until engineering and environmental studies can be completed. A more-extensive review of the energy sector is available at the U.S. Energy Information Administration Web site at URL http://www.eia.doe.gov/emeu/cabs/ghana2.html.

Outlook

Despite a favorable political and investment climate, the prospects for continued development of the key mining sector of the Ghanaian economy were threatened by weak commodity prices, particularly for gold, and by high energy costs between 1999 and 2001. Weak gold and cocoa prices have reduced the foreign exchange generation capacity of the country and slowed the strong economy growth of the late 1990s. The return of the gold price to more than $300 per ounce in early 2002 held promise for the revitalization of the gold sector, although a number of the small- and medium-sized gold mines were faced with depleting mineral resources and a limited remaining mine life. Owing to periodic droughts, domestic energy supply, especially hydroelectric power, has been a problem particularly for the aluminum industry and the expanding needs of the gold industry. Although new gas-fueled powerplant developments will help mitigate this problem, the long-term solution of Ghana's energy problems rested with implementation of the WAGP.

References Cited

Ashanti Goldfields Co. Ltd., 2002, Annual report—2001: Accra, Ghana, Ashanti Goldfields Co. Ltd., March, 68 p.

Barning, Kwasi, ed., 1997, Industrial mineral resources of Ghana: Ghana Minerals Commission, 94 p.

Glencar Mining plc., 2002, Annual Glencar report, 2001: Dublin, Ireland, Glencar Mining plc. June 28, 41 p.

Golden Star Resources Ltd., 2002, Annual report—2001: Denver, Colorado, Golden Star Resources Ltd., March, 90 p.

Gold Fields Limited-Repadre Capital Corporation, 2002, Gold Fields and Repadre finalises purchase of Damang gold mine: Gold Fields Limited-Repadre Capital Corporation joint press release, January 24, 2 p.

Moydow Mines International Inc., 2001, Mining license granted at Ntotoroso: Dublin, Ireland, Moydow Mines International Inc. press release, July 18, 2 p.

Newmont Mining Corp., 2001, Newmont to create world's largest gold producer with acquisitions of Normandy Mining and Franco-Nevada Mining: Denver, Colorado, Newmont Mining Corp. press release, November 14, 10 p.

Normandy Mining Ltd., 2000, Annual Normandy Mining Ltd. shareholder report, 2000: Adelaide, Australia, Normandy Mining Ltd., August, 88 p.

Ranger Minerals Ltd., 2001, Damang operations: Mount Peasant, Australia, Ranger Minerals Ltd., annual report 2001, 65 p.

Red Back Mining NL, 2002, Annual report for financial year ended June 30, 2002: Perth, Australia, Red Back Mining NL, 40 p.

Resolute Ltd., 2001, Purchase of Abore Mining Company Limited: Perth, Australia, Resolute Ltd. press release, July 24, 2 p.

St. Jude Resources Ltd., 2002, Annual information form for the year ended January 31, 2002: Vancouver, British Columbia, Canada, St. Jude Resources Ltd., 28 p.

Internet References Cited

Akrokeri-Ashanti Gold Mines, Inc., 2002a, Bonte Gold Mines Ltd., The Properties, accessed July 31, 2002, at URL http://www.aagm.com/bonte_gold_mine.htm.

Akrokeri-Ashanti Gold Mines, Inc., 2002b, Goldenrae, The Properties, accessed July 31, 2002, at URL http://www.aagm.com.

Chevron Nigeria Ltd., 1999 (August 16), Chevron named project manager for West African gas pipeline project, Press Release, accessed July 30, 2001, via URL http://www.chevrontexaco.com/news/archive/chevron_press/1999/1999-08-16.asp.

Ghana Ministry of Finance, 2002 (February 21), The budget statement and economic policy of the Government of Ghana for the 2002 financial year, accessed July 26, 2002, at URL http://www.ghanaweb.com/GhanaHomePage/ghana/ECONS/budget.html.

Gold Fields Ltd., 2001 (September 1), Resources and reserves—Managing Director's report, Annual Report for the Financial Year Ending June 30, 2001, accessed July 28, 2002, at URL http://www.goldfields.co.za/annual_report/ar2001/intro.htm).

Gold Fields Ltd., 2002, Production history—Excel spreadsheets, Quarterly Results December 2001, accessed July 28, 2002, at URL http://www.goldfields.co.za/quarterly/finyear_02/dec01/default.htm.

Kaiser Aluminum & Chemical Corp., 2002 (April 12), Form 10-K for 2001 to U.S. Securities and Exchange Commission, accessed July 22, 2002, at URL http://www.sec.gov/Archives/edgar/data/54291/000005429102000005/0000054291-02-000005.txt.

U.S. Energy Information Administration, 2001 (August), Ghana, Country Analysis Brief, accessed August 1, 2002, at URL: http://www.eia.doe.gov/emeu/cabs/ghana2.html.

Other Sources of Information

Ministry of Mines and Energy
P.O. Box 40
Stadium, Accra, Ghana
Telephone: 233-21-667151-3, 667090
Fax: 233-21-668262

Geological Survey Department
P.O. Box M 80
Accra, Ghana
Telephone: 233-21-228093

Minerals Commission
P.O. Box M 248
Accra, Ghana
Telephone: 233-21-772-786 or 779-824
Fax: 233-21-773-324 or 763-053
E-mail: mincom@mincomgh.org

Mines Department
P.O. Box 3634
Accra, Ghana
Telephone: 233-21-776802
Fax: 233-31-24344 (Takoradi office)

Digitized by Google

Ghana National Petroleum Corp.
Petroleum House
Private Mail Bag
Tema, Ghana
Telephone: 233-22-206020 or 204654
Fax: 233-22-232039 or 206088
E-mail: gnpc@ghana.com
Internet: http://www.gnpc.com.gh

Ghana Chamber of Mines
P.O. Box 991, Minerals House #10
6th Senchi Street, Airport
Accra, Ghana
Telephone: 233-12-760652 or 761893
Fax: 233-12-760653
E-mail: chamine@ghana.com

Other Publication

Kesse, G.O., 1985, The mineral and rock resources of Ghana: Rotterdam, Netherlands, A.A. Balkema, 610 p.

TABLE 1
GHANA: PRODUCTION OF MINERAL COMMODITIES 1/

(Thousand metric tons unless otherwise specified)

Commodity 2/		1997	1998	1999	2000	2001
Aluminum:						
Bauxite, gross weight		504	442	355	504	715
Metal, smelter, primary		152	56	104	142	162
Arsenic, trioxide 3/	metric tons	4,577	5,000 e/	7,000	-- e/	--
Cement, hydraulic 4/		1,700 e/	1,630	1,870	1,950	1,900
Diamond:						
Gem e/	thousand carats	664	649	544	736	700
Industrial e/	do.	166	160	136	184	170
Total 5/	do.	830	809	680	920 e/	870
Gold 6/	kilograms	54,662	72,541	79,946	72,080	68,699
Manganese:						
Ore, processed		437	537	639	896	813
Mn content e/		149	172	204	287	260
Petroleum:						
Crude	thousand 42-gallon barrels	2,600	2,190	2,190	2,555 r/	3,285
Refinery products: e/						
Liquefied petroleum gas	do.	350	-- 7/	-- r/ 7/	625	625
Gasoline	do.	3,300	1,460 7/	1,825 r/ 7/	5,850	5,850
Jet fuel	do.	350	365 7/	365 r/ 7/	625	625
Kerosene	do.	1,100	730 7/	730 r/ 7/	1,950	1,950
Distillate fuel oil	do.	2,500	1,460 7/	2,190 r/ 7/	4,450	4,450
Residual fuel oil	do.	700	1,460 7/	2,190 r/ 7/	1,250	1,250
Other including refinery fuel and losses	do.	700	1,825 7/	730 r/ 7/	1,250	1,250
Total	do.	9,000	7,300 7/	8,030 r/ 7/	16,000	16,000
Salt e/		50	50	50	50	50
Silver, content of exported dore e/	kilograms	2,730 r/	3,630	3,950	6,100 r/	1,945
Steel, secondary, rebar e/		75 r/	75	75	75	75 e/

e/ Estimated; estimated data are rounded to no more than three significant digits. r/ Revised. -- Zero.
1/ Table includes data available through July 2002.
2/ In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone) are produced as are limestone and lime for processing of some gold ore and salt. Output of these commodities is not reported and information is inadequate to make reliable estimates of output levels.
3/ Bogosu Gold Ltd.'s gold ore roaster closed in 1996. Ashanti Goldfields Co. Ltd.'s Obuasi roaster closed in June 2000.
4/ All from imported clinker.
5/ Production, in thousand carats, includes that of Akwatia Mine (1997--300 (estimated); 1998--252; 1999--205; 2000--233; 2001--nil. Remainder are artisanal sales to the Precious Metals Marketing Corp. Estimates of unreported artisanal production not included.
6/ Does not include estimate of smuggled or undocumented production.
7/ Reported figure.

Digitized by Google

TABLE 2
GHANA: STRUCTURE OF THE MINERAL INDUSTRY IN 2001

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum		Volta Aluminum Co. Ltd. (Valco) (Kaiser Aluminum & Chemical Corp., 90%; Reynolds Aluminum Co., 10%)	Aluminum smelter at Tema	200.
Bauxite		Ghana Bauxite Co. Ltd. (Alcan Aluminum Ltd., 80%; Government, 20%)	Bauxite mine at Awaso	1,000.
Cement		Ghana Cement Works Ltd. (Heidelberg Zement AG of Germany, 94.5%)	Clinker grinding plant at Takoradi	1,200.
Do.		do.	Clinker grinding plant at Tema	1,200.
Diamond	thousand carats	Ghana Consolidated Diamonds Ltd. (Government, 100%)	Placer mine at Akwatia, in Birim Valley	360.
Gold	kilograms	Ashanti Goldfields Co. Ltd. [Depositary Nominee, Inc. (Ashanti), 36.1%; Lonmin, Plc. of the United Kingdom, 31.5%; Government, 19%; other private, 13.4%]	Total capacity Of which: Obuasi underground mine (surface mines closed mid-2000) Iduapriem/Teberebie Mine Bibiani Mine Ayanfuri Mine (closed early 2001)	31,000. (17,000). (9,000). (5,000). (1,800).
Do.	do.	Abosso Goldfields Ltd. (Gold Fields Ltd., 71.1%; Repadre Capital Corp., 18.9%; Government, 10%)	Damang Mine near Tarkwa (acquired from Ranger Minerals Ltd. January 2002)	9,000.
Do.	do.	Prestea Gold Resources Ltd. (acquired by former Prestea employees in 1999; undergorund rights below 200 meters)	Prestea underground mine (closed in September 1998)	1,100.
Do.	do.	Bogosu Gold Ltd. (Golden Star Resources Ltd., 90%; Government, 10%)	Open pit mine at Bogosu (oxide mining phasing out in 2001)	3,100.
Do.	do.	do.	Prestea surface rights (acquired from Barnato Exploration Ltd. and Prestea Gold Resources Ltd. in 2001)	NA.
Do.	do.	Bonte Gold Mines Limited (Akrokeri-Ashanti Gold Mines Inc., Canada, 85%; Government, 10%; Buosiako Co. Ltd. of Ghana, 5%)	Placer mine at Jeni River, about 40 kilometers southwest of Kumasi	1,100.
Do.	do.	Gold Fields (Ghana Ltd.) (Gold Fields Ltd., 71.1%; Repadre Capital Corp. of Canada, 18.9%; Government, 10%)	Tarkwa open pit mines and heap leach (full capacity planned by 2003)	17,000.
Do.	do.	Prestea Sankofa Gold Ltd.	Prestea tailings retreatment operation	650.
Do.	do.	Resolute Amansie Ltd. [Resolute Ltd. (Australia), 90%; Government, 10%]	Obotan Mine 40 km northwest of Obuasi (acquired Abore Mine in 2001)	3,100.
Do.	do.	Satellite Goldfields Ltd. [Wassa Holdings Ltd., 90% (of which Glencar Mining plc. of Ireland holds 66%); Government, 10%]	Wassa Mine, 30 km northwest of Tarkwa (offered for sale to Golden Star Resources Ltd. in 2001)	3,730.
Limestone and lime		Carmeuse Lime Products (Ghana) Ltd. (Carmeuse SA of Belgium)	Sekondi	NA.
Manganese ore		Ghana Manganese Company Limited (Government, minority interest)	Open pit mine at Nsuta-Wassaw in Western region	650 (processed ore).
Steel		Ferro Fabrik	Steel mill at Tema (secondary)	20 (rod, rebar, and wire).
Do.		Tema Steel Co. (subsidiary of Ghana Industrial Holdings Co.) (Government, 100%)	do.	25 (rebar).
Do.		Wahome Steel Ltd. (private Taiwanese investors, 95%; Ghanaian investor, 5%)	do.	30 (rod, rebar, and wire).
Petroleum, crude	thousand 42-gallon barrels	Ghana National Petroleum Corp. (Government, 100%)	Saltpond and Tano Fields	3,500.
Petroleum products	do.	Tema Oil Refinery Limited (Government, 100%)	Refinery at Tema	16,500 (crude input).

NA Not available.

Digitized by Google

TABLE 3
GHANA: GOLD PRODUCTION BY COMPANY AND MINE

(Kilograms)

Company	Mine	1997	1998	1999	2000	2001
Abosso Goldfields Ltd.	Damang, open pit	--	8,421	9,446	9,881	9,420
Ashanti Goldfields Co. Ltd.	Ayanfuri, open pit 1/	1,807	1,440	1,382	1,130	358
Do.	Bibiani	--	4,719	8,146	8,513	7,871
Do.	Iduapriem/Teberebie, open pits 2/	4,560	4,828	5,092 r/	5,191	6,380
Do.	Asikam, alluvial (Midras Mining Ltd.) 3/	--	233	34	--	--
Do.	Obuasi, underground (open pit closed 2000)	26,687	27,537	23,113	19,937	16,437
Total		33,054	38,757	37,767	34,771	30,688
Barnex (Prestea) Ltd.	Prestea, underground and surface rights 4/	1,011	600	894	--	--
Bogosu Gold Ltd. 5/	Bogosu, open pit	3,464	3,813	4,058 r/	3,379	2,735
Bonte Gold Mines Limited	Esaase and Jeni River, placer	879	1,093	1,515 r/	2,134	2,031
Dunkwa Continental Goldfields Ltd.	Dunkwa, placer	118	37	1	--	--
Gold Fields (Ghana) Ltd.	Tarkwa, underground	1,672	1,670	1,269	--	--
Do.	Tarkwa, open pit, 1998 startup	--	2,522	6,806	11,272	16,392
Obenemasi Gold Mines Ltd.	Konongo/Obenemasi, open pit	176	--	--	--	--
Precious Minerals Marketing Corp. 6/	Artisanal workings	3,331	1,873	2,302 r/	1,968	1,446
Prestea Sankofa Gold Ltd.	Prestea Sankofa, tailings 7/	626	467	373	371	--
Resolute Amansie Ltd.	Obotan, open pit	2,151	5,411	4,230 r/	4,199	3,447
Satellite Goldfields Ltd.	Wassa, open pit, 1999 startup 8/	--	--	2,712 r/	3,266	2,182
Teberebie Goldfields Ltd. 9/	Teberebie, open pit	8,180	7,877	8,573	839	
Grand total		54,662	72,541	79,946	72,080	68,341

r/ Revised. -- Zero.

1/ Closed in early 2001.

2/ Includes production from Teberebie for 2001.

3/ Sold by Ashanti Goldfields Co. Ltd. in 1999 and closed in 2000.

4/ Surface rights acquired by Golden Star Resources Ltd. from Barnex (Prestea) Ltd. (Western Areas Ltd. of South Africa) in 2001 to be used to extend life of the adjacent Bogosu Mine. Prestea Gold Resources Ltd. will retain rights to old Prestea underground mine.

5/ Acquired by Golden Star Resources Ltd. (U.S.), 70%, and Anvil Mining NL (Australia), 20%, in 1999. Golden Star acquired Anvil's 20% interest in 2001.

6/ Includes 8 to 110 kilograms per year of byproduct gold from Ghana Consolidated Diamonds Ltd.'s Akwatia Mine. Includes gold purchases from small-scale miners by Miramex and other licensed buying authorities.

7/ Acquired by Ashanti in purchase of SAMAX, Inc. in 1998; sold in 1999. Included in Ashanti's total for 1998.

8/ Acquired by Golden Star Resources Ltd. from Glencar Mining plc. and Moydow Mines International Inc. in November 2001 and placed on care and maintenance pending reappraisal.

9/ Acquired by Ashanti (ore reserves) and Gold Fields (heap leach facilities) from Pioneer Group Inc. in mid-2000.

Sources: Ghana Minerals Commission, Ghana Chamber of Mines, and company reports.

Digitized by Google

Digitized by Google

THE MINERAL INDUSTRIES OF

KENYA AND UGANDA

By Thomas R. Yager

KENYA

The mineral industry in the East African country of Kenya has been chiefly noted for its production of fluorspar, salt, and soda ash. Other industrial minerals produced in recent years included barite, diatomite, feldspar, gypsum, lime, silica sand, and vermiculite. Building materials produced included cement, coral, granite, limestone, marble, and shale. Kenya has produced small amounts of metal products, which included gold and secondary aluminum, lead, and steel. The country also produced carbon dioxide, gemstones, and refined petroleum products (table 1).

In 2001, Kenya's gross domestic product (GDP) increased by 1.2% after decreasing by 0.1% in 2000 and rising by 1.3% in 1999 and 1.6% in 1998. The GDP was $38.6 billion at purchasing power parity and $11.7 billion at market exchange rates. In 2000, manufacturing accounted for 13% of GDP; construction, 4%; utilities, 2%; and mining and quarrying, less than 1%. From 1995 to 2000, the mining and quarrying sector grew by an average of 1.7% per year. During the same period, employment in the mining industry grew to 5,300 from 4,720 (International Monetary Fund, 2002a, p. 106, 118; 2002b, p. 174; 2002a§[1]-c§).

Government Policies and Programs

New environmental laws that affect most types of mining operations, which include alluvial diamond mining, alumina, clay, coal, heavy mineral sands, limestone and other quarries, gemstones, phosphate, precious metals, and slate, as well as exploration and production for petroleum, came into effect in January 2001 (African Mining Intelligence, 2001b). Kenya faced numerous environmental issues related to mining, which include fluorite poisoning in the Keiro Valley, mercury pollution from the processing of gold in the western part of the country, the effects of dust produced in the mining and processing of diatomite, air pollution from escaped volatiles from the production of soda ash at Lake Magadi, and habitat destruction from quarries.

In May 2001, Kenya resumed work on drafting the overhaul of its mining legislation. Lack of information about Kenya's mineral resources has made attracting foreign investors difficult; the Government started a program to update resource data in January 2001 (Africa Mining Intelligence, 2001a, b).

[1]References that include a section twist (§) are found in the Internet References Cited section.

Trade

Kenya's mineral exports increased to $57 million in 2001 from $50 million in 2000; mineral exports accounted for 2% to 3% of total exports. Soda ash accounted for nearly 51% of mineral exports in 2001; gold, 23%; fluorspar, 16%; and gemstones, 10% (Jerono, 2002§; R.M. Mutiso, Kenya Mines and Geological Department, written commun., August 20, 2001). In recent years, Kenya also has exported cement and petroleum products. Mineral, metal, and fuel imports included aluminum, bentonite, crude petroleum, gypsum, kaolin, lead, salt, steel, and zinc.

Commodity Review

Metals

Gold.—Numerous deposits of gold, which include the greenstone belts in the western part of Kenya, occur. Most of Kenya's gold production was artisanal; International Gold Exploration (IGE) AB, which owned the Teng Teng Mine and production facilities, was the only large-scale mining company operating in 2001. In 2000, the value of gold produced in Kenya amounted to $10.3 million (R.M. Mutiso, Kenya Mines and Geological Department, written commun., August 20, 2001).

IGE planned to conduct further exploration near the Teng Teng Mine and at the Sekerr and Wakorr prospects in 2002. In January 2001, Kansai Mining Corporation signed an agreement to acquire all the shares of Mid Migori Mining Company Ltd., which held the licenses to the Kakamega and Migori prospects. Azimut Exploration Inc. abandoned the Busia property in February (Resource Information Unit, 2001a).

Iron and Steel.—Anwarali & Brothers Ltd. and Athi River Mining Ltd. (ARM) mined small amounts of iron ore, which were used in the production of cement. Production of crude steel ceased in 1998. Kenya had four rolling mills with a combined capacity of 220,000 metric tons per year (t/yr) (table 2); these companies relied upon imported billet. Mabati Rolling Mills Ltd., which was the largest producer of flat steel products in East Africa, exported 87,000 metric tons (t) of galvanized and cold rolled steel products, mainly to other African countries, in 2001 (East African Standard, 2002§).

The International Iron and Steel Institute (2001, p. 81, 91) estimated that Kenya's imports of semimanufactured and finished steel products amounted to 303,000 t in 2000. This was a decrease from 347,000 t in 1999 and 341,000 t in 1995.

Digitized by Google

From 1995 to 2000, Kenya's apparent consumption of finished steel fell to 321,000 t from 359,000 t.

Lead.—Associated Battery Manufacturers (East Africa) Ltd. operated Kenya's only secondary lead refinery at Athi River. The company also explored for lead near the Kenyan coast. National production of lead amounted to about 1,000 t/yr, and consumption, 3,000 t/yr (Opiyo-Akech, 2001; International Lead and Zinc Study Group, 2002, p. 6, 8).

Titanium and Zirconium.—Substantial deposits of mineral sands that contain ilmenite, rutile, and zircon occur in southeastern Kenya. Tiomin Resources Inc. planned to mine the Kilifi, Kwale, Mamburi, and Vipingo deposits sequentially; the company decided to focus on the Kwale Project first owing to its higher grades of economically recoverable minerals. During the first 6 years, output would be more than 300,000 t/yr of ilmenite, 75,000 t/yr of rutile, and 37,000 t/yr of zircon. The capital costs for the Kwale Project were estimated to be $137 million; cash flow was expected to be $47 million per year (Africa Energy & Mining, 2000; Industrial Minerals, 2000).

Tiomin planned to start production in the first quarter of 2003 if it obtained mining licenses in early 2001. In March, however, parties opposed to the Kwale Project on environmental grounds won an injunction that will prevent Tiomin from engaging in exploration or development from the High Court of Kenya. The court cited the new environmental legislation implemented in January 2001 to support its decision to halt the Kwale Project until more information was available on its environmental effects (Africa Mining Intelligence, 2001b, c).

Zinc.—Kenya was known to have deposits of zinc, but none were being mined. The country consumed 12,000 t/yr of imported zinc for such applications as the production of galvanized steel. In 2001, Ambase Exploration explored for copper and zinc resources near the Kenyan coast. In February 2001, Azimut abandoned work on the Yala property, which contained the Bumbo polymetallic deposit (Opiyo-Akech, 2001; Resource Information Unit, 2001a; International Lead and Zinc Study Group, 2002, p. 40).

Industrial Minerals

Carbon Dioxide.—Carbacid Ltd. exploited resources of natural carbon dioxide at Kereita in the Kaimbu district. In 2000, East African Breweries Ltd., which accounted for about 30% of Carbacid's production, announced plans to build its own carbon dioxide production facility (Akumu, 2000§).

Cement.—In 2001, Kenya's cement industry suffered from severe overcapacity. Production fell to less than 1.09 million metric tons, and the combined capacity of Kenya's three cement manufacturers was about 2.8 million metric tons per year (Mt/yr) (tables 1, 2). Domestic demand for cement fell in 2000 and 2001 owing to weakness in the construction sector. Export markets (particularly in Uganda) have become more competitive; this development was partially attributable to high energy costs in Kenya. In 2000, the value of cement produced in Kenya amounted to $101.8 million (Daily Nation, 2001§; Mburu, 2001§; R.M. Mutiso, Kenya Mines and Geological Department, written commun., August 20, 2001).

Diatomite.—Numerous deposits of diatomite occur in the Great Rift Valley. African Diatomite Industries Ltd. produced high-grade diatomite for domestic and export markets at Soysambu and Kariandusi in the Nakuru district (Opiyo-Akech, 2001).

Fluorspar.—Kenya Fluorspar Ltd. exploited deposits in the Keiro Valley. Kenya exported most of its fluorspar production for use in the manufacture of hydrofluoric acid; domestic consumers of fluorspar included the cement and glass industries. In 2000, the value of fluorspar produced in Kenya amounted to $8.2 million (R.M. Mutiso, Kenya Mines and Geological Department, written commun., August 20, 2001).

Gemstones.—Kenya was a producer of numerous gemstones, which include amethyst, aquamarine, cordierite, green garnet, ruby, sapphire, and tourmaline (table 1). The majority of Kenya's gemstones were produced from the Taita Taveta district; other gemstone deposits include agate in the northern Rift Valley, amazonite, and fluorite.

Rockland Kenya Ltd. was the country's largest producer and exporter of ruby. Gemkit Enterprises Ltd., which was a significant ruby producer in the Kwale district, explored for sapphire in the Isolo district. Kikisa Ltd. mined ruby in the West Pokot district. In the Taita Taveta district, Bridges Exploration Ltd. and First Green Garnet Mining Co. Ltd. mined tsavorite, which is a green grossular garnet that obtains its color from chromium and vanadium. Megalith Mining Co. explored for gemstones in the Taita Taveta district (Opiyo-Akech, 2001).

In 2000, the value of gemstones produced in Kenya amounted to $3.66 million. The largest contribution came from ruby, with a value of $1.18 million, followed by rhodolite garnet, $840,000; green garnet, $744,000; tourmaline, $477,000; and sapphire, $395,000 (R.M. Mutiso, Kenya Mines and Geological Department, written commun., August 20, 2001). Although a small gem-cutting industry has developed, most of Kenya's gemstone exports were rough stones.

Granite and Limestone.—Bamburi Cement Ltd. exploited coral limestone along the Kenyan coast. ARM exploited the Kajiado and Kaloleni deposits near Mombasa for use in the Kaoleni cement and lime plants. Lime also was produced by Homa Lime Company Ltd. About 32,000 t/yr of limestone was used for dimension stone; granite and marble deposits were exploited for use as dimension stone at Kakamega, Kisii, Machakos, and Makueni. The production of granite and marble dimension stone fell sharply in 2000 (table 1).

Kaolin and Other Clays.—Deposits of kaolin were found in the Nyeri district north of Nairobi. ARM produced small amounts of kaolin for use in ceramic tiles, paper, paint, and rubber products. The company mined bentonite at Ndulutu and

Digitized by Google

china clay at Karatina. In 2000, small amounts of kyanite and other clays also were mined in Kenya (table 1).

Salt.—Lake Magadi, which is in the Great Rift Valley, contains notable resources of salt. Magadi Soda Ash Co. Ltd. extracted salt as a byproduct of the soda ash production process. Other salt producers included Krystalline Salt Ltd., Mombasa Salt Works Ltd., and Salt Manufacturers Kenya Ltd. In 2000, the value of salt produced in Kenya amounted to $672,000 (R.M. Mutiso, Kenya Mines and Geological Department, written commun., August 20, 2001).

Silica Sand.—ARM exploited the deposits of silica sand that occurred at Kaloleni. Anwarali & Brothers Ltd. and Central Glass Industries Ltd. also mined silica sand. Central Glass Industries manufactured glass bottles and containers; the company exported about 50% of its output. Impala Glass Industries Ltd. produced flat glass for automotive and construction applications.

Soda Ash.—The trona resources at Lake Magadi were exploited by Magadi Soda Ash Co. The company exported most of its production; domestic consumers of soda ash included the caustic soda, detergent, and glass industries. In 2000, the value of soda ash produced in Kenya amounted to $25.4 million (R.M. Mutiso, Kenya Mines and Geological Department, written commun., August 20, 2001).

Sulfur.—Kenya's known deposits of sulfur are small and uneconomic. The country, however, produced an estimated 19,000 t of sulfuric acid for domestic industrial consumption from imported sulfur (table 1).

Vermiculite.—Kenmag Investments Ltd. mined vermiculite at Lodosoit in the Makueni district. In 2000, the value of vermiculite exported from Kenya amounted to $713,000. Kenya was expected to import vermiculite from Uganda's new mine at Namekhela for use in horticulture and construction (R.M. Mutiso, Kenya Mines and Geological Department, written commun., August 20, 2001; Wakabi, 2001§).

Mineral Fuels

Kenya did not produce crude petroleum and relied on imports for its refinery. Imports of crude petroleum increased to about 18 million barrels (Mbbl) in 2000 from 15.7 Mbbl in 1999 and 12.33 Mbbl in 1995. In 2000, imports of fuels and lubricants accounted for 25% of Kenya's total imports (International Monetary Fund, 2002a, p. 117, 140). In recent years, Iran and the United Arab Emirates have supplied Kenya with crude petroleum. Imports of petroleum products have been sourced from Bahrain, South Africa, and Saudi Arabia.

Kenya Petroleum Refinery Ltd. (KPRL) was the country's only refinery. It had a capacity of 90,000 barrels per day but has produced at about 40% capacity in recent years (table 1). KPRL needed nearly $200 million for rehabilitation and upgrading. In July 2001, the Government issued a decree mandating that Kenya's importers and distributors of petroleum products refine part of their products at KPRL (Africa Energy Intelligence, 2001e).

Dana Petroleum plc of the United Kingdom announced plans for a seismic survey to identify drilling prospects in blocks L5, L7, and L10; work was expected to start in 2002. Star Petroleum International (Kenya) Ltd. was Dana's partner on these blocks. In 2001, the Government was negotiating with Afrex Ltd. over three offshore blocks in the Turkana region (Africa Energy Intelligence, 2001b).

Infrastructure

In January 2001, the Government announced that electric power would no longer be rationed. A prolonged drought had severely reduced Kenya's ability to generate electric power in 1999 and 2000. Capacity expansions, imports from Uganda, the rehabilitation of retired capacity, and the use of emergency generators allowed the country to compensate for the effects of the drought.

The Government planned to expand domestic capacity and reduce reliance on hydroelectric power. From 2000 to 2005, generating capacity was expected to increase by 528 megawatts (MW), of which thermal accounted for 260 MW; hydroelectric, 140 MW, and geothermal, 128 MW. By 2017, geothermal capacity was expected to increase by 531 MW. The Sondu-Miriu hydroelectric project was expected to resume in January 2002; the project had been stalled for more than a year owing to environmental concerns. The project would divert the Sondu-Miriu River to a 60-MW powerplant. In June 2001, the Government announced that the 74-MW Kipevu II thermal power station would come online in September (Mwangi, 2000; Africa Energy Intelligence, 2001c, d).

The Governments of Kenya, Tanzania, and Zambia signed an agreement for Kenya to increase its imports of electricity from Tanzania and Zambia. The three Governments also discussed interconnections between their power grids. The Government of Uganda offered to increase its exports to Kenya to 110 MW of capacity in 2002 and 2003 and 190 MW in 2004 from 30 MW in 2001 (Africa Energy Intelligence, 2001a, f).

Kenya had about 63,800 kilometers (km) of roads, of which approximately 8,900 km was paved. The rail network covered 2,700 km. Pipelines for petroleum products covered about 480 km. Lake Victoria was a major waterway for internal commerce.

Outlook

The outlook for Kenya's cement and other construction materials depended mostly upon the strength of the domestic economy. GDP growth was expected to be 1.4% in 2002 and 2.8% in 2003 (International Monetary Fund, 2002b, p. 174).

The outlook for fluorspar, gemstones, gold, soda ash, and titanium depends heavily on world market conditions. Modest decreases in expected gold mine production by 2003 are likely to be offset by falling demand. Demand for soda ash is expected to increase by 2.5% per year from 2003 to 2007, and production capacity is expected to increase by 0.5% per year

Digitized by Google

during the same period. Demand for titanium dioxide pigment is expected to increase by about 3% to 4% per year from 2002 to 2006. About 95% of all titanium dioxide is consumed to produce titanium oxide pigment. Fluorspar production was expected to fall to 95,000 t in 2002 (Gambogi, 2001; SG Securities Ltd., 2001, p. 22; Chemical Week, 2002).

UGANDA

In recent years, the East African country of Uganda has been known to produce cobalt, gold, limonite and other iron ore, columbium (niobium), steel, tantalum, tin, and tungsten. Uganda also has produced such industrial minerals as apatite, gypsum, kaolin and other clays, lime, and salt, and such building materials as cement, limestone, and pozzolanic materials (table 1).

Uganda's GDP increased by 5.6% in 2001 after rising by 5% in 2000, 7.6% in 1999, and 4.7% in 1998. The GDP was $31.9 billion at purchasing power parity, and $6.9 billion at market exchange rates. During the fiscal year ending in June 2001 (fiscal year 2000-01), the construction sector grew by 2.8%; electricity and water, 9.3%; manufacturing, 8.9%; and mining and quarrying, 5.9%. In fiscal year 2000-01, the manufacturing sector accounted for 9.9% of GDP; construction, 7%; electricity and water, 1.5%; and mining and quarrying, less than 1% (International Monetary Fund, 2002b, p. 174; 2002a§-c§; Uganda Ministry of Finance, Planning and Economic Development, 2002, p. 14).

The value of mineral production amounted to about $24 million in 2001; mineral exports were about $70 million. In 2001, the Ministry of Energy and Minerals granted 106 mineral licenses and renewed 34. During the same year, 80 licenses expired, and 172 were still current (Uganda Ministry of Energy and Mineral Development, 2002, p. 38).

Government Policies and Programs

By June 2002, the Government planned to implement a new mining law to replace the Mining Act of 1964; licenses, royalties and taxes, and environmental provisions will be affected. The Government also planned a 5-year project to conduct geological surveys and to appraise mineral occurrences. The project was expected to cost $25 million; the Government sought funding from the African Development Bank, the Nordic Development Fund, and the World Bank (Uganda Ministry of Energy and Mineral Development, 2002, p. A6.12-A6.14).

In 2001, a report issued by the United Nations Security Council accused Ugandan Government officials, military officers, and businessmen of illegally exploiting columbium (niobium), diamond, gold, and tantalum from Congo (Kinshasa) to enrich themselves and to finance their country's military presence in Congo (Kinshasa). Others accused of using their military presence to exploit Congolese mineral resources included rebel forces operating in Congo (Kinshasa) and the Governments of Namibia, Rwanda, and Zimbabwe. In July 2001, a board of inquiry chaired by a judge on Uganda's High Court began to investigate these accusations (Africa Mining Intelligence, 2001d; United Nations Security Council, 2001a, p. 16- 21, 25, 29-37; 2001b, p. 6-11, 16-23).

Commodity Review

Metals

Cobalt.—Kasese Cobalt Co. Ltd. (KCCL) recovered cobalt from the Kilembe stockpile through bioleaching and solvent extraction electrowinning. In 2001, Normandy Mining Ltd., which owned 63% of KCCL through its affiliate Banff Resources Ltd. of Canada, indicated that it wanted to sell its assets in KCCL. The Kasese cobalt project was plagued by high operating costs and falling world cobalt prices. In 2001, the value of cobalt produced in Uganda amounted to more than $14 million (Africa Mining Intelligence, 2001e; J.T. Tuhumwire, Uganda Geological Survey and Mines Department, written commun., July 8, 2002).

Columbium (Niobium) and Tantalum.—Uganda's deposits of columbium (niobium) and tantalum at Nyakasopu, Nyanga, and Rugomera were mined during the 1930s and 1960s. In 2001, Uganda Gold Mining Ltd. began recovering tantalite from tailings at the Nyanga property. The company planned a test program that would process 8,000 t of tailings, establish the grade and tonnage of the tailings, and set the stage for larger scale production. The test program would employ 50 to 100 artisanal miners. Uganda Gold Mining also acquired three exclusive prospecting licenses on properties close to Nyanga. Other companies that had licenses granted or renewed included Nabisoga Mining Ltd. and V.E.K. Global Mining Co. Ltd. in the Ntungamo district (African Mining, 2001; Engineering & Mining Journal, 2001; Uganda Ministry of Energy and Mineral Development, 2002, p. 38-39).

Gold.—In 2001, several gold exploration companies had licenses granted or renewed, including Anglo-Uganda Corporation PLC and Kisita Mining Ltd. in the Mubende district. International Roraima Gold Corporation held licenses at Bude-Kitoja, Makina-Anonikakeni, and Mbarara. In September 2000, a cease-trade order was issued against the company for failing to file required financial statements. In December 2001, the company was delisted from the Canadian Venture Exchange. Mincor Resources NL relinquished its interest in Roraima's licenses. Glencar Mining plc held the Buinja, Bulumbi-Makina, and Lumino licenses, and International Gold Exploration Ltd. held the Buhwezu license (Resource Information Unit, 2001b; Uganda Ministry of Energy and Mineral Development, 2002, p. 38).

After rising to 56 kg in 2000 from 5 kg in 1999, Uganda's gold production fell to less than 1 kg in 2001 (table 1). Gold exports fell to 6,090 kg in 2001 from 7,300 kg in 2000. The value of gold exports, however, increased by 13% to $58.61 million in 2001. Gold accounted for 84% of Uganda's mineral exports. The majority of gold exports were reported to be re-exports from Congo (Kinshasa) (Uganda Ministry of Energy and Mineral Development, 2002, p. 40).

Iron and Steel.—Uganda's deposits of iron ore were located at Kyanyamuzinda, Metuli, Mugabuzi, Muko, Sukulu, and

Digitized by Google

Wambogwe. In January 2000, Muko Iron Ore Development Co. Ltd. (MIDECO) was developed to exploit the Muko deposit on a commercial basis. MIDECO planned to use the direct reduction process to produce sponge iron that could be used in the Ugandan steel industry. The $25 million project was expected to consume 60,000 t/yr of coal; MIDECO was considering the use of Tanzanian coal in the production process (Musoke, 2000§).

Uganda had two producers of crude steel with a combined capacity of 46,000 t/yr and four rolling mills with a combined capacity of 165,200 t/yr (table 2). Uganda's demand for steel products amounted to about 200,000 t/yr; the domestic rolling mills produced about 80,000 t/yr, and 120,000 t/yr was imported. Domestic production of crude steel amounted to only 7,000 t/yr. The local rolling mills were forced to use steel scrap as raw material, which was in short supply and usually mixed with other metals (Musoke, 2000§).

Lead.—Uganda Batteries Ltd. operated the country's only secondary lead refinery at Kampala. The company's production was estimated to be nearly at its capacity of 1,000 t/yr.

Tin.—Uganda's tin production increased to 18 t in 2001 from 6 t in 2000 (table 1). In September, the Government indicated that the state-owned Karuruma Tin Works (KTW) would be privatized; an invitation to tender for KTW was expected to be issued before the end of 2001. Castile Foundry of South Africa, the Metal Processing Association of Rwanda, and Pyromet Technologies (Pty.) Ltd. of South Africa planned to make a joint bid for KTW. Pyromet offered $650,000 for KTW and pledged to invest $1.9 million in the company (Africa Mining Intelligence, 2001f).

Tungsten.—Deposits of wolframite occur at Bahati, Buyaga, Kirwa, Mpororo, Nyamulilo, Ruhizha, and Rushanga. Krone Uganda Ltd. mined the Nyamulilo deposit and exported its output to the United States. Production has been limited by a lack of electricity, infrastructure, and modern equipment. Uganda's tungsten production amounted to 17 t in 2001 (table 1; Olaki, 2002§).

Industrial Minerals

Cement.—Two local factories with a combined capacity of about 600,000 t/yr supplied Uganda's cement market (table 2). Uganda's cement production increased by nearly 6% in 2000 (table 1); the consumption of cement increased by 10% owing to rising demand in the housing sector. Housing accounted for 45% of the demand for cement; infrastructure and public works, 20%; and industry, 15%. Cement was exported to Congo (Kinshasa), Rwanda, and Tanzania. Uganda imported cement and clinker from India, Indonesia, Japan, and Kenya (International Cement Review, 2001, p. 296; Mburu, 2001§).

Clay.—The most substantial resources of brick clay are at Kajansi and Namanve. The expansion of the construction sector has led to increased demand for brick clay. Uganda's production of clay bricks and tiles increased to 20,744 t in 2000 from 15,817 t in 1995. The country's total production capacity for clay bricks and tiles was 50,000 t/yr (Uganda Investment Authority, 2001, p. 5).

Kaolin.—Deposits of kaolin were found at Buwambo, Kisai, Kilembe, Kuluva, Lunyenye, Mutaka, and Namasera. At Buwambo, a local company mined and processed small amounts of kaolin for use in manufacturing paint. Uganda's kaolin also may be used to manufacture floor and wall tiles in the future.

Limestone.—Uganda's deposits of limestone were used by the cement industry; limestone was found at Bukiribo, Dura, Gweri Hill, Hima, and Tororo Hill. In 2001, the production of limestone fell to 229,792 t from 253,032 t in 2000. The value of limestone produced amounted to about $10.2 million in 2001 (J.T. Tuhumwire, Uganda Geological Survey and Mines Department, written commun., July 8, 2002).

Phosphate Rock.—Uganda has substantial resources of phosphate rock at the Bukusu and Sukulu deposits. In 2001, Foskor SA replaced Rhodia Chime SA as Madhvani International SA's partner in promoting the $300 million Sukulu phosphate project. Rhodia Chime still planned to participate in feasiblity studies and testing rock samples. Foskor and Madhvani hoped to produce 100,000 t/yr of granulated triple superphosphate and 1 Mt/yr of phosphate rock. In the fifth year of the project, the two companies planned to produce sodium tripolyphosphate detergent (Minerals Gazette, 2001).

Salt.—Resources of salt were found at Lake Katwe. General Agencies Ltd. produced small amounts of salt; most of Uganda's salt demand has been met through imports in recent years.

Silica Sand.—Deposits of silica sand occur in the Masaka and Mukono districts. The Government and private companies have studied the feasibility of using these sands to produce container glass, sheet glass, and tableware. In recent years, Saudi Marble Co. Ltd. has produced small amounts of silica sand.

Vermiculite.—In 2001, Canmin Resources Ltd. (a subsidiary of International Business Investments Corp.) started the production of vermiculite from the Namekhela deposit. Canmin planned to produce 40,000 t/yr of vermiculite for domestic consumption and export to African, European, and Middle Eastern countries. The Namekhela vermiculite is a high-quality material well suited to insulation and horticultural applications (Industrial Minerals, 2001, 2002; Wakabi, 2001§).

Mineral Fuels

In 2001, Heritage Oil and Gas Ltd. and its joint-venture partner Energy Africa carried out exploration work and an environmental impact assessment in exploration area 3, which covers the Semliki Basin. The first exploration well was expected to be drilled in the third quarter of 2002. Energy

Digitized by Google

Africa was also in a joint venture with Hardman Resources Ltd. in exploration area 2, which covers the northern part of Lake Albert. The companies signed a production-sharing agreement with the Government in October 2001. China National Petroleum Corporation signed a memorandum of understanding with the Government in January (Uganda Ministry of Energy and Mineral Development, 2002, p. 28-30).

Uganda does not have production facilities for crude petroleum or petroleum products. In 2001, Uganda consumed about 3.45 Mbbl of imported petroleum products, which was an increase from 3.36 Mbbl in 2000 and 2.68 Mbbl in 1996. Consumption of diesel amounted to 1.3 Mbbl; gasoline, 1.26 Mbbl; kerosene, 349,000 barrels (bbl); jet fuel, 276,000 bbl; fuel oil, 243,000 bbl; and liquified petroleum gas, 18,000 bbl (Uganda Ministry of Energy and Mineral Development, 2002, p. A3.3).

Infrastructure

Uganda's electricity production increased to 1,593 gigawatt hours (GWh) in 2001 from 1,555 GWh in 2000 and 1,130 GWh in 1996. After electricity losses of 535 GWh, domestic electricity sales amounted to nearly 913 GWh, most of which came from hydroelectric power sources. About 223 GWh was consumed by industrial users. Exports of electricity fell to 145 GWh of electricity in 2001 from 251 GWh in 2000; the decline was probably attributable to Kenya's alleviation of its own severe power shortages (Uganda Ministry of Energy and Mineral Development, 2002§).

The Government of Uganda offered to increase its exports to Kenya to 110 MW of capacity in 2002 and 2003 and 190 MW in 2004 from 30 MW in 2001. Norpak Power Ltd. planned to build a 200-MW hydroelectric plant at Karuma in northern Uganda, but construction was unlikely to start until a new supply contract was signed between the Governments of Kenya and Uganda. In December 2001, the World Bank approved funding of $215 million for the 250-MW Bujagali hydroelectric powerplant. AES Nile Power Ltd., which agreed to invest $111 million for the project, would build the plant on a build-own-operate basis. Other projects included the 14-MW Kakira Sugar Works Ltd. plant to generate power from fiber residue of sugar cane, and several small hydropower projects in western Uganda with a total capacity of 30 MW (Africa Energy Intelligence, 2001f, g; Uganda Ministry of Mineral and Energy Development, 2002, p. 11-12; World Bank, 2002, p. 33).

In March 2001, the Uganda Electricity Board (UEB) was divided into three successor companies. Uganda Electricity Generation Company Ltd. took over the Kiira and Nalubale hydroelectric plants; Uganda Electricity Transmission Company Ltd. took over transmission; and Uganda Electricity Distribution Company Ltd. took over distribution. The UEB maintained responsibility for isolated diesel powerplants. The Government started to seek bidders for the privatization of generation and distribution in June (Uganda Ministry of Energy and Mineral Development, 2002, p. 6-7).

In December, the World Bank approved the Energy for Rural Transformation (ERT) Program. The ERT was a plan developed by the Government and the African Rural and Renewable Energy Initiative of the World Bank to increase Uganda's rural electrification to at least 10% by 2012 from 1% in 2001. The plan included several small hydropower projects and solar energy programs (Uganda Ministry of Energy and Mineral Development, 2002, p. 10-13).

Uganda had about 27,000 km of roads, of which approximately 1,800 km was paved. The rail network covered about 1,240 km. Lake Albert, Lake George, Lake Edward, Lake Yoga, Lake Victoria, the Albert Nile River, and the Victoria Nile River were the country's principal waterways.

Outlook

The International Monetary Fund (2002b, p. 174) predicted that Uganda's GDP would grow by 5.7% in 2002 and 6.5% in 2003. If the construction industry grows at a similar rate, then the production of such construction materials as brick clay, cement, gypsum, limestone, pozzolanic materials, and sand and gravel could increase substantially.

The prospects for cobalt, columbium (niobium), gold, tantalum, tin, and tungsten depends heavily upon world market conditions for these commodities. Columbium (niobium) demand is driven primarily by the steel and aerospace industries. Global consumption of finished steel has been predicted to fall by about 0.7% in 2002 and to rise by 2.3% per year from 2003 to 2006. Tin consumption is expected to decline by about 1% in 2002 and to increase by nearly 3.6% in 2003. Cemented carbides represent the greatest end use of tungsten. Future consumption depends upon the strength of the aerospace, construction, mining, oil and gas drilling, semiconductor, and other manufacturing industries. More information on the world gold market can be found in the "Kenya" part of this report (SG Securities Ltd., 2001, p. 19, 22; Shedd, 2002, p. 81.5; MEPS (International) Ltd., 2002§).

References Cited

Africa Energy & Mining, 2000, Kenya—No delay for Kwale project: Africa Energy & Mining, no. 283, September 27, p. 7.

Africa Energy Intelligence, 2001a, Kenya—Hope for the power sector: Africa Energy Intelligence, no. 291, January 24, p. 2.

Africa Energy Intelligence, 2001b, Kenya—Juniors step forward: Africa Energy Intelligence, no. 308, October 17, p. 3.

Africa Energy Intelligence, 2001c, Kenya—Kipevu II to be commissioned in July: Africa Energy Intelligence, no. 300, June 6, p. 7.

Africa Energy Intelligence, 2001d, Kenya—New start at Sondu-Miriu: Africa Energy Intelligence, no. 312, December 12, p. 6.

Africa Energy Intelligence, 2001e, Kenya—No way of getting around it: Africa Energy Intelligence, no. 304, August 22, p. 7.

Africa Energy Intelligence, 2001f, Kenya/Uganda—Norpak caught between Kampala and Nairobi: Africa Energy Intelligence, no. 303, July 18, p. 6.

Africa Energy Intelligence, 2001g, Uganda—Sugar-cane power: Africa Energy Intelligence, no. 293, February 21, p. 6.

Africa Mining Intelligence, 2001a, Kenya—More foreign eyes on prospects: Africa Mining Intelligence, no. 7, January 31, p. 2.

Africa Mining Intelligence, 2001b, Kenya—New mining legislation still awaited: Africa Mining Intelligence, no. 23, October 10, p. 1.

Africa Mining Intelligence, 2001c, Kenya—Tiomin at grips with farmers: Africa Mining Intelligence, no. 14, May 16, p. 3.

Africa Mining Intelligence, 2001d, Uganda—Kampala looks into looting of Congo gold: Africa Mining Intelligence, no. 19, July 25, p. 3.

Digitized by Google

Africa Mining Intelligence, 2001e, Uganda—Normandy wants to quit Kasese: Africa Mining Intelligence, no. 24, October 24, p. 2.
Africa Mining Intelligence, 2001f, Uganda—Sell-off for tin company: Africa Mining Intelligence, no. 22, September 26, p. 7.
African Mining, 2001, Exploration—Uganda: African Mining, v. 6, no. 4, July-August, p. 16.
Chemical Week, 2002, Product outlook—Soda ash: Chemical Week, v. 164, no. 22, May 29, p. 38-39.
Engineering & Mining Journal, 2001, Regionals—Uganda: Engineering & Mining Journal, v. 202, no. 7, July, p. 16HH-16LL.
Gambogi, Joseph, 2001, Titanium: Engineering & Mining Journal, v. 202, no. 4, April, p. 50-52.
Industrial Minerals, 2000, Kenya—Kwale minsands feasibility upbeat: Industrial Minerals, no. 393, June, p. 15.
Industrial Minerals, 2001, Uganda—Canmin to begin vermiculite production: Industrial Minerals, no. 400, January, p. 18.
Industrial Minerals, 2002, Mineral notes—Ugandan vermiculite: Industrial Minerals, no. 412, January, p. 76.
International Cement Review, 2001, Uganda, *in* Global cement report: Dorking, United Kingdom, Thaneship Publications, Ltd., p. 296.
International Iron and Steel Institute, 2001, Steel statistical yearbook 2001: Brussels, Belgium, International Iron and Steel Institute, 109 p.
International Lead and Zinc Study Group, 2002, Lead and zinc statistics: London, United Kingdom, International Lead and Zinc Study Group, May, 67 p.
International Monetary Fund, 2002a, Kenya—Selected issues and statistical appendix: Washington, DC, International Monetary Fund, April, 158 p.
International Monetary Fund, 2002b, World economic outlook—Trade and finance: Washington, DC, International Monetary Fund, September 25, 235 p.
Minerals Gazette, 2001, Foskor now key player in Uganda phosphate mine: Minerals Gazette, v. 2, no. 43, May, p. 32.
Mwangi, Martin, 2000, Country update report for Kenya 1995-1999, *in* Proceedings of the World Geothermal Conference 2000, Tahoka, Japan, May 28-June 10: Tahoka, Japan, International Geothermal Association, p. 327-335.
Opiyo-Akech, Norberto, 2001, Kenya, *in* Mining annual review 2001: London, United Kingdom, Mining Journal Ltd. CD-ROM.
Resource Information Unit, 2001a, Kenya, *in* Register of African mining 2001/02: Subiaco, Australia, Resource Information Unit, p. 145-148.
Resource Information Unit, 2001b, Uganda, *in* Register of African mining 2001/02: Subiaco, Australia, Resource Information Unit, p. 307-309.
SG Securities Ltd., 2001, Quarterly metals review—A mountain to climb: London, United Kingdom, SG Securities Ltd., October, 28 p.
Shedd, K.B., 2002, Tungsten, *in* Metals and minerals: U.S. Geological Survey Minerals Yearbook 2000, v. I, p. 81.1-81.18.
Uganda Investment Authority, 2001, Building & construction sector profile: Kampala, Uganda, Uganda Investment Authority, 25 p.
Uganda Ministry of Energy and Mineral Development, 2002, Annual report of the ministry—2001: Kampala, Uganda, Uganda Ministry of Energy and Mineral Development, 109 p.
Uganda Ministry of Finance, Planning and Economic Development, 2002, Background to the budget financial year 2002/03: Kampala, Uganda, Uganda Ministry of Finance, Planning and Economic Development, 93 p.
United Nations Security Council, 2001a, Report of the panel of experts on the illegal exploitation of natural resources and other forms of wealth of the Democratic Republic of the Congo—Report no. S/2001/357: New York City, New York, United Nations Security Council, 56 p.
United Nations Security Council, 2001b, Addendum to the report of the panel of experts on the illegal exploitation of natural resources and other forms of wealth of the Democratic Republic of the Congo—Report no. S/2001/363: New York City, New York, United Nations Security Council, 38 p.
World Bank, 2002, Uganda—Third power project, fourth power project, and Bugajali hydropower project—Management report and recommendation in response to the inspection panel investigation report: Washington, DC, World Bank, June 17, 33 p.

Internet References Cited

Akumu, Washington, 2000 (May 16), Sh105m for gas plant causes jitters, accessed July 18, 2002, at URL http://www.nationaudio.com/News/DailyNation/16052000/Features/XX4.html.
Daily Nation, 2001 (August 29), Lean times for cement firms, accessed July 18, 2002, at URL http://www.bamburicement.com/newsclip13.htm.
East African Standard, 2002 (July 16), Mabati mills steel exports hit the U.S. market, accessed July 19, 2002, at URL http://allafrica.com/stories/printable/200207160357.html.
International Monetary Fund, 2002a (April), Gross domestic product at current prices—All countries, World Economic Outlook Database, accessed August 14, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/01/data/ngdpd_a.csv.
International Monetary Fund, 2002b (April), Selected world aggregates, World Economic Outlook Database, accessed June 10, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/01/data.
International Monetary Fund, 2002c (April), Shares of aggregate GDP based on purchasing power parity (PPP) valuation of country GDP—Developing countries, World Economic Outlook Database, accessed June 10, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/01/data.
Jerono, Clarice, 2002 (November 16), Kenya earns Sh4.5b from minerals, accessed November 21, 2002, at URL http://www.eastandard.net/Saturday/Business/bus16112002001.htm.
Mburu, Chris, 2001 (October 29), East Africa cement makers form regional body, accessed July 18, 2002, at URL http://www.nationaudio.com/News/EastAfrican/05112001/Business/Business1.html.
MEPS (International) Ltd., 2002, Abstract from global iron and steel production to 2006, accessed April 23, 2002, via URL http://www.meps.co.uk/Global%20Tables.html.
Musoke, David, 2000 (July 10), Ugandan firm clinches $25 million iron ore mining deal, accessed July 10, 2000, at URL http://www.nationaudio.com/News/EastAfrican/10072000/Business/Business3.html.
Olaki, Emmy, 2002 (March 28), Wolfram mine set to take off, accessed July 18, 2002, at URL http://allafrica.com/stories/printable/200203280656.html.
Wakabi, Wairagala, 2001 (July 16), Now Uganda set to export vermiculite, accessed July 22, 2002, at URL http://www.nationaudio.com/News/EastAfrican/24072001/Business/Business1.html.

Digitized by Google

TABLE 1
KENYA AND UGANDA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Country and commodity		1997	1998	1999	2000	2001
KENYA 2/						
Aluminum, secondary e/		2,400	2,400 r/	2,400 r/	2,400 r/	2,400
Barite e/		20	10	-- r/ 3/	-- r/ 3/	--
Carbon dioxide gas, natural		9,214	8,498	10,006	7,744 r/	5,645
Cement, hydraulic	thousand tons	1,506	1,426	1,204	1,146 r/	1,085
Clays:						
Bentonite		NA	NA	--	64	50
Kaolin		500 e/	500 e/	192 r/	793 r/	700
Kyanite		NA	NA	NA	(4/)	--
Other		NA	NA	15,000	18,000	17,000 e/
Diatomite		297	468	3,587 r/	3,634 r/	3,500
Feldspar e/		120 r/	115 r/	115 r/	82 r/ 3/	73 3/
Fluorspar (acid grade)		68,700	60,854	93,602	100,102 r/	108,000
Gemstones, precious and semiprecious:						
Amethyst 5/	kilograms	104	166	514 r/	1,107 r/	1,100 e/
Aquamarine 5/	do.	12	15	1,216 r/	132 r/	130 e/
Cordierite (iolite) 5/	do.	19	34	444 r/	280 r/	270 e/
Green garnet 5/	do.	18,181	5,186	1,174 r/	1,763 r/	1,700 e/
Rhodolite garnet 5/		NA	NA	1,214	3,409	3,300 e/
Ruby	kilograms	5,175	4,001	4,488 r/	5,896 r/	5,862
Sapphire 5/	do.	615	3,313	7,232 r/	10,686 r/	10,000 e/
Tourmaline	do.	6,969	3,790	4,617 r/ 5/	18,844 r/ 5/	18,000 e/
Gold, mine output, Au content	do.	440 5/	388 5/	990	1,243 r/	1,200 e/
Gypsum and anhydrite e/		11,900 r/	11,300 r/	9,500 r/	8,416 r/ 3/	8,200 3/
Iron ore		NA	NA	NA	790	920
Lead, refined, secondary		1,000	1,000	1,000	1,000	1,000
Lime e/		15,000	16,000	4,473 r/ 5/	1,282 r/ 5/	1,200
Petroleum refinery products:						
Gasoline	thousand 42-gallon barrels	2,555	2,555	2,481 r/	2,828 r/	2,800 e/
Kerosene and jet fuel	do.	2,920 r/	2,555 r/	2,676 r/	3,175 r/	3,100 e/
Distillate fuel oil	do.	3,285	3,285	3,798 r/	4,531 r/	4,500 e/
Residual fuel oil	do.	3,650	3,650	2,871 r/	3,402 r/	3,400 e/
Liquified petroleum gas	do.	365	365	314 r/	395 r/	300 e/
Other	do.	730	730	127 r/	134 r/	100 e/
Total	do.	13,505	13,140	12,267 r/	14,465 r/	14,200 e/
Salt, crude		6,280	21,742	44,886	16,359 r/	5,664
Soda ash		257,640	242,910	245,680	238,190 r/	297,780
Steel, crude e/	thousand tons	33	25	-- r/ 3/	-- r/ 3/	--
Stone, sand and gravel:						
Coral e/	do.	500	500	-- r/ 3/	-- r/ 3/	--
Granite for dimension stone		500 5/	1,619 5/	860 r/	182 r/	170 e/
Limestone for cement	thousand tons	700	700	700	690 e/	650 e/
Limestone for dimension stone	do.	32,935	32,000	32,000	32,000 r/	31,000
Marble for dimension stone		966 5/	84 5/	433 r/	116 r/	110 e/
Sand, industrial (glass) e/		13,000	12,000	12,000	11,800	11,500
Shale e/		200,000	180,000	180,000	177,000	170,000
Sulfuric acid		20,000	20,000	20,000	20,000	20,000
Vermiculite		1,418	353	164 5/	124 r/ 5/	--
UGANDA 6/						
Cement, hydraulic		289,560	321,329	347,274	367,500 r/	416,000 e/
Cobalt		--	--	77	411	634
Columbite-tantalite, ore and concentrate:						
Gross weight	kilograms	--	--	--	2,712	11,092
Nb content	do.	--	--	--	841	3,439
Ta content	do.	--	--	--	1,418	5,801
Gold, mine output, Au content	do.	6	8	5	56	(4/)

See footnotes at end of table.

Digitized by Google

TABLE 1--Continued
KENYA AND UGANDA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Country and commodity	1997	1998	1999	2000	2001
UGANDA--Continued 6/					
Gypsum	--	2,000 e/	256	--	--
Iron ore:					
Limonite	NA	NA	3,169	2,231	--
Other	2,432	300 e/	61	2,401	1,236
Kaolin	NA	NA	198	14	90
Lime, hydrated and quick e/	10,000 r/	10,000 r/	10,000 r/	10,000 r/	10,000
Limestone	919,353	300,000 e/	121,524	253,032	229,792
Phosphate minerals, apatite	--	(4/) e/	(4/) e/	-- r/	--
Pozzolanic materials	NA	NA	20,213	35,603	22,782
Salt e/	10,000 r/	5,000 r/	5,000 r/	5,000 r/	5,000
Steel e/	7,400 r/	7,400 r/	7,900 r/	7,000	7,000
Tin, mine output, Sn content	2	1	(4/)	6 r/	18
Tungsten, mine output, W content	--	--	(4/)	--	17
Vermiculite	--	--	--	--	100

e/ Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. r/ Revised. NA Not available. -- Zero.
1/ Includes data available through January 27, 2003.
2/ In addition to the commodities listed, a variety of minerals and construction materials [brick clays, coal, gravel, meerschaum, mica, murram (laterite), crushed rock, and construction sand] may be produced, but quantities are not reported, and information is inadequate to make estimates of output.
3/ Reported figure.
4/ Less than 1/2 unit.
5/ Exports.
6/ In addition to the commodities listed, the following are presumably produced, but information is inadequate to estimate output: clay, copper content of slag corundum, lead, marble, sand and gravel, and silica sand.

Digitized by Google

TABLE 2
KENYA AND UGANDA: STRUCTURE OF THE MINERAL INDUSTRIES IN 2001

(Metric tons unless otherwise specified)

Country and commodity	Major operating companies	Location of main facilities	Annual capacity
KENYA			
Carbon dioxide gas, natural	Carbacid Ltd.	Kereita	NA
Cement	Bamburi Cement Ltd.	Mombasa	1,100,000
Do.	do.	Nairobi	1,000,000
Do.	East African Portland Cement Co. Ltd.	Athi River	550,000
Do.	Athi River Mining Ltd.	Kaloleni	110,000
Diatomite	African Diatomite Industries Ltd.	Kariandusi and Soysambu	4,000
Fluorspar	Kenya Fluorspar Ltd.	Kerio Valley	120,000
Glass	Central Glass Industries Ltd.	Nairobi	51,100
Do.	Impala Glass Industries Ltd.	do.	NA
Gold kilograms	International Gold Exploration AB	Akala, Lolgorien, and Kisii	155
Lead, refined secondary	Associated Battery Manufacturers Co. Ltd.	Athi River	3,000
Lime	Homa Lime Company Ltd.	Koru	30,000
Petroleum, refined thousand barrels	Kenya Petroleum Refineries Ltd. [Government, 50%; British Petroleum plc, Caltex Oil (Kenya) Ltd., and Royal Dutch/ Shell Group, 50%]	Mombasa	32,850
Salt	Magadi Soda Ash Ltd.	Magadi	40,000
Do.	Krystalline Salt Ltd.	Nairobi	NA
Do.	Mombasa Salt Works Ltd.	Mombasa	NA
Do.	Salt Manufacturers Kenya Ltd.	do.	NA
Soda ash	Magadi Soda Ash Ltd.	Magadi	300,000
Steel:			
Crude	Kenya United Steel Co. Ltd. (E.A. Wire Industries Ltd., 81%)	Mombasa	20,000
Rolled	Mabati Rolling Mills Ltd.	do.	120,000
Do.	Standard Rolling Mills Ltd.	do.	40,000
Do.	Kenya United Steel Co. Ltd.	do.	30,000
Do.	Steelmakers Ltd.	do.	30,000
Vermiculite	Kenmag Investments Ltd.	Lodosoit	2,000
UGANDA			
Cement	Tororo Cement Industries Ltd.	Tororo	360,000
Do.	Hima Cement Industries Ltd. (Bamburi Cement Ltd., 70%)	Kasese	240,000
Cobalt	Kasese Cobalt Company Ltd. (Banff Resources Ltd., 63%; Government, 25%; International Finance Corp., 8%; Société de Promotion et de Participation pour la Coopération Economique, 4%)	do.	1,000
Lead, refined secondary	Uganda Batteries Ltd.	Kampala	1,000
Steel:			
Crude	East African Steel Corp. Ltd. (subsidiary of Madhvani Group)	Jinja	25,000
Do.	Steel Rolling Mills Ltd. (subsidiary of Alam Group Ltd.)	do.	21,000
Billet	Steel Corporation of East Africa Ltd.	do.	60,000
Rolled	do.	do.	101,200
Do.	Steel Rolling Mills Ltd.	do.	24,000
Do.	BM Technical Services Ltd.	Mbarara	20,000
Do.	Sembule Steel Mills Ltd.	Kampala	20,000
Tungsten	Krone Uganda Ltd.	Nyamurilo	115
Vermiculite	Canmin Resources Ltd. (subsidiary of International Business Investments Corp.)	Namekhela	NA

NA Not available.

Digitized by Google

THE MINERAL INDUSTRY OF

LESOTHO

By George J. Coakley

The Kingdom of Lesotho is a landlocked, independent parliamentary constitutional monarchy surrounded by South Africa. The economy is based on subsistence agriculture, livestock, and remittances from miners employed in South Africa. The country has long been known as a source of diamond, mostly from alluvial deposits. Mineral production, however, has not been a significant part of the economy and has contributed around 3% of the gross domestic product (GDP) between 1995 and 2001 (International Monetary Fund, 2002§[1]). Artisanal miners produced a small amount of clay, crushed stone, and sand and gravel for domestic consumption. Artisanal diamond production was around 1,500 carats per year. The nation supported a population of 2.18 million people in a 30,350-square-kilometer area. The country's GDP was estimated to be $5.1 billion on the basis of purchasing power parity in 2000 and grew at a rate of 2.5% in 2000 (the latest year for which data were available); the GDP per capita was $2,400 (U.S. Central Intelligence Agency, 2002§). HIV/AIDS remained a major social and economic problem for Lesotho; the latest United Nations report showed a 31% HIV/AIDS infection rate among the adult population between 15 and 49 at yearend 2001 (Joint United Nations Programme on HIV/AIDS, 2002§).

Repatriated wages from Basotho miners who worked in the South African gold mines have historically contributed significantly to the national income. With the restructuring of the South African mining industry and the decline in world gold prices, however, the average number of Basotho workers employed in South African mines between 1997 and 2001 has declined to 59,900 from 95,900. Worker remittances back to Lesotho represent about 61% of their total earnings. Between 1997 and 2000, miners' remittances declined to 1.196 billion maloti[2] ($149.5 million) from 1.321 billion maloti ($264.2 million) (International Monetary Fund, 2002§).

Commercial interest in the mineral resources of Lesotho was limited to diamond. The Lesotho Geological Survey has identified 33 kimberlite pipes and 140 dikes, of which 24 are diamondiferous. MineGem Inc. (formerly Messina Diamond Corp.) of Canada operated two locally incorporated companies involved with diamond exploration and development and held licenses that covered two mineralized zones within the Liqhobong kimberlite area. Liqhobong Mining Development Company (Pty.) Ltd. (LMDC) [MineGem (65%), the Industrial Development Corporation (IDC) of South Africa (22.5%), and the Government (12.5%)] held a mining lease that gave it the right to mine the Satellite Pipe; it was granted in June 2001. Maluti Diamonds Pty. Ltd. (MineGem, 90%) held a 3-year prospecting license to explore and conduct a feasibility study on the Main Pipe at Liqhobong. The Liqhobong property is located in the northern highlands about 120 kilometers east-northeast of the capital of Maseru. Under LMDC's mining lease, the company had the right to mine for 5 years with an option to extend the lease for an additional 5 years. An 8% gross sales revenue is payable to the Government, and LMDC will give the Government a 12.5% free equity interest in the Satellite Pipe Mine. In March 2000, the completed feasibility study on the Satellite Pipe project showed an indicated resource above the 2,225-meter (m) elevation of 1.4 million metric tons (Mt) of ore at a grade of 69 carats per 100 metric tons with an average value of $41.24 per carat. An additional 1.07 Mt of inferred resource was reported between the 2,525- and 2,400-m elevations. A capital cost of $7.5 million, which was based on an exchange rate of R6.9=$1.00, would be required to start up a mining operation at a rate of 420,000 metric tons per year of ore, which would yield 290,000 carats per year. An environmental impact assessment completed along with the feasibility study and an environmental management and mitigation plan was accepted by the Government in December 2000. In October 2001, the IDC exercised its option to acquire a 10% interest in LMDC; in April 2002, however, the IDC decided not to exercise its option to fund the Satellite Mine project and to acquire a 40% interest in LMDC. Subsequently, MineGem opened negotiations with Florence Worldwide Finance Limited (a subsidiary of DGI Group of Israel) to obtain financing to develop the Satellite Pipe Mine and to complete a bankable feasibility study on the Main Pipe (MineGem Inc., 2002, p. 7-12).

Letseng Diamonds (Pty.) Ltd. and its partner New Mining Corporation of South Africa (88%), which was a black empowerment group spun off during the unbundling of JCI Ltd., and the Government (12%) announced plans in 2000 to reopen mining of the kimberlite pipes at Lets'eng-la-Terae. The Government can acquire an additional 12% equity interest through reinvestment of future dividends. De Beers Consolidated Mines Ltd. recovered 289,000 carats from the mine between 1977 and 1982. A capital investment of around $17 million would be required to reopen a satellite open pit and to reprocess 5 Mt of low-grade stockpiled ore left by De Beers. During 2001, Letseng Diamonds was in the process of developing and reestablishing a mining operation and associated infrastructure to extract diamonds from the underlying deposits. Remaining resources included 12 Mt down to 140 m depth at the satellite pit and 50 Mt of ore down to 300 m in the old main pipe. The mine was expected to produce more than 50,000

[1]References that include a section twist (§) are found in the Internet References Cited section.

[2]Where necessary, values have been converted from Lesotho maloti (M) to U.S. dollars at the rate of M8.0 = US$1. 00 for 2000, and M5.0 = US$1. 00 for 1997. The maloti trades at par with the South African rand (R).

Digitized by Google

carats per year during its 20-year life. Although the average resource grade was only 3 carats per 100 tons, the frequency of large, higher value stones above 10 carats was 10 times higher than other kimberlites. About 15% of the diamonds to be mined were expected to be larger than 10 carats and 1.5% larger than 100 carats (Tassel, 2000).

In an April 2002 filing with the Johannesburg Stock Exchange, Consolidated African Mines Limited (CAM) announced its plans to merge with JCI Gold. CAM will acquire a 40% interest in Letseng Investment Holdings (South Africa) (Pty) Limited (the holding company of Letseng Diamonds) from JCI Gold. Efforts to complete final funding requirements for construction of a new processing plant were ongoing in early 2002. CAM expected the value of diamond production at Letseng to exceed $635 per carat (Consolidated African Mines Ltd. and JCI Gold Limited, 2002§).

The revival of the diamond mining industry in Lesotho showed hope for some new opportunities for Basotho mineworkers displaced from the South African gold mines and for replacing related lost Government revenues.

References Cited

MineGem Inc., 2002, Annual report for 2001: Toronto, Ontario, Canada, MineGem Inc., May 13, 20 p.

Tassel, Arthur, 2000, Letseng—Lesotho's sky-high diamond mine: African Mining, v. 5, no. 4, July-August, p. 25-27.

Internet References Cited

Consolidated African Mines Ltd. and JCI Gold Limited, 2002 (April 18), Merger of CAM and JCI Gold, Announcement to the Johannesburg Stock Exchange, accessed July 2, 2002, via URL http://www.bfanet.com/articles/displaysens.asp?articleid=272465.

International Monetary Fund, 2002 (May 3), Lesotho—Statistical annex, Country Report No. 02/97, accessed June 25, 2002, at URL http://www.imf.org/external/pubs/cat/longres.cfm?sk=15814.0.

Joint United Nations Programme on HIV/AIDS , 2002 (July), Report on the global HIV/AIDS epidemic, accessed July 3, 2002 at URL http://unaids.org/barcelona/presskit/embargo.htm.

U.S. Central Intelligence Agency, 2002, Lesotho, World Factbook, accessed July 3, 2002, at URL http://www.odci.gov/cia/publications/factbook/index.html.

Major Sources of Information

Ministry of Natural Resources
P.O. Box 772
Maseru, Lesotho
Telephone: (266) 322-491

Department of Mines and Geology
P.O. Box 750
Maseru 100, Lesotho
Telephone: (266) 322-842 or 323-750
E-mail: geosurv@mines.gov.ls

TABLE 1
LESOTHO: ESTIMATED PRODUCTION OF MINERAL COMMODITIES 1/

Commodity		1997	1998	1999	2000	2001 2/
Fireclay	cubic meters	30,000	30,000	35,000	35,000	34,000
Diamond	carats	1,500	9,660 2/	1,500	1,500	1,140
Stone, quarry products:						
Dimension stone	square meters	10,000	10,000	12,000	12,000	13,357
Gravel and crushed rock	cubic meters	180,000	180,000	180,000	180,000	180,000

1/ Includes data available through June 2002.
2/ Reported data from Lesotho Department of Mines and Geology for financial year ending in April of year shown.

Digitized by Google

THE MINERAL INDUSTRY OF

LIBYA

By Philip M. Mobbs

After the suspension of United Nations economic sanctions in 1999, there was a general expectation that a significant increase in international investment in the mineral industry of Libya would be forthcoming. This expectation ceased in August 2001 when the U.S. Congress continued economic sanctions with the passage of Public Law 107-24 (the ILSA Extension Act of 2001), which extended the Iran and Libya Sanctions Act of 1996 through 2006. Citizens and organizations of the United States were prohibited from exporting or importing most goods and services to Libya. The sanctions also were to apply to any non-American business association; company; corporation; governmental entity operating as a business enterprise; nongovernmental entity, organization, or group; partnership; society; or trust; and any parent, subsidiary, successor to any of the above business entities that invested more than $20 million per year in the development of Libyan petroleum resources. The United States had banned imports of Libyan crude oil with Presidential Proclamation 4907 in 1982 and had originally imposed an embargo on Libya in 1986 and enforced it under the Libyan sanctions regulations (31 CFR part 550).

In 2001, the country had a population estimated to be about 5.2 million. The fall in international oil prices adversely affected the Libyan economy. According to the International Monetary Fund (2002§[1]), the nominal gross domestic product of this North African nation dropped to $28.6 billion in 2001 from $34.9 billion in 2000. The hydrocarbon sector accounted for about 98% of Libya's foreign exchange revenues.

Libya's petroleum reserves, which were estimated to be about 29.5 billion barrels, were the largest on the African continent (U.S. Energy Information Administration, 2002). Libya was the second largest crude oil producer in Africa after Nigeria; exports of Libyan crude oil and petroleum products to the United States, however, had ceased in 1982. Natural gas reserves were estimated to be about 1.31 trillion cubic meters and were relatively undeveloped compared with those of other countries in the North African region (Quinlan, 2002).

Government Policies and Programs

Laws that regulated foreign investment in Libya's mineral industry included law 5 [Encouragement of Foreign Capital Investment Law of 1426 (1997)] and law 25 (Petroleum Law of 1955). In 2000, the Ministry of Energy had been disbanded. Its duties had been transferred to National Oil Corp. (NOC) (Townsend, 2002).

[1]References that include a section twist (§) are found in the Internet References Cited section.

Commodity Review

With the exception of state-owned Libyan Iron and Steel Co. (LISCO), which was supplied primarily by imported raw materials, the nation's nonfuel mineral industry sector made a negligible impact on the economy. The nonfuel mineral sector included the production of ammonia and urea at the Marsa El Brega ammonia plant; the manufacture of cement by Arabian Cement Co. and Libyan Cement Co.; the quarrying of clay, gypsum, and limestone near Al Khums; the quarrying of limestone and dolomite and the production of lime and calcined dolomite for LISCO at As Seddadah; and the extraction of salt from the coastal plains near Benghazi and Tripoli.

The Government proposed a number of state company projects for which joint ventures would be considered. These included investment in a $250 million, 100,000-metric-ton-per-year (t/yr)-capacity glass plant, which would use local raw materials; an expansion of Arab Cement Co.'s Libda ($242 million) and Zliten ($169 million) cement plants; an expansion of Libyan Cement Co.'s Fataih cement plant ($166 million); a $28 million sodium silicate plant; a $20 million modification of the LISCO electric arc furnace; the construction and installation of a $17 million ladle furnace for LISCO; a $5 million 1,500-t/yr rock wool plant; and a $3.8 million 24,000-t/yr salt refinery. The Government also was promoting the development of a number of mineral deposits, which included clay, gypsum, iron, lead, salt, sodium carbonate, and stone (General Industrialization Corp., 2002a§-c§).

In 2001, with the extension of U.S. sanctions, the decline in international oil prices, and the deferred consideration of a new petroleum law, the anticipated surge in oil and natural gas exploration activity failed to materialize. Still, oil and gas exploration by international oil companies was expected to increase significantly, given the extensive underexplored areas in the country (Rusk, 2000). Negotiations continued for the exploration of the blocks that had been offered to investors in 2000.

Natural Gas.—Agip Nord Africa B.V. (a subsidiary of Eni S.p.A. of Italy) and state-enterprise NOC of Libya continued the development of two natural gas fields in western Libya—the C structure on offshore block NC-41 and the Wafa prospect on block NC-169. Total project investment was projected to be $4.5 billion (Townsend, 2002). In 2001, drilling began on the onshore Wafa prospect, and the design of three 270-metric-ton-per-day sulfur recovery units for the Melitah gas treatment plant was completed (Middle East Economic Digest, 2001c). The

Digitized by Google

project was scheduled to deliver 8 billion cubic meters per year to Europe by mid-2004 (Quinlan, 2002).

Oil.—In 2001, contracts awarded for the development of offshore block NC-137 included a $54 million contract for the engineering, procurement, installation in 90 meters of water, and construction of a steel jacket; a 35,000 barrel-per-day (bbl/d)-capacity production platform; and a $32 million agreement to provide facilities associated with a 900,000-barrel storage capacity floating, production, storage, and offloading vessel and a mooring system. The operator Cie. des Petroles Total Libye and partners NOC and Wintershall AG of Germany expected initial production of crude oil to begin in 2003 (Middle East Economic Digest, 2001b).

Work progressed on the planned 50,000-bbl/d-capacity Elephant Field on block NC-174. Development costs were estimated to be $500 million (Middle East Economic Digest, 2001a). Eni, which acquired Lasmo plc (the former operator) in January 2001, was the operator of the block. Other participants in the block included Agip Nord Africa B.V. and a consortium of Korean companies, which included the Daesung Group, Daewoo International Corp., Hyundai Corp., Korea Petroleum Development Corp., and the Majuko Group. Initial production is expected in 2003.

In a surprise move, Lundin Oil AB sold its 25% interest in the En Naga prospects on block NC-177 to Petro-Canada. NOC held the other 75% interest in the block. Lundin had acquired its stake in the project in 2000, shortly after the Government declared that the block was eligible for development. Three of five planned development wells were completed in 2001, and production (about 14,000 bbl/d) was expected to begin in 2002 (Petro-Canada, 2002, p. 3).

In March, NOC announced that it was reviewing the concessions of the Oasis Group (Amerada Hess Corp., Conoco Inc., and Marathon Oil Corp.). The Oasis Group and Occidental Petroleum Corp. had been forced to withdraw from Libya in 1986 with the imposition of sanctions by the United States. In May 2001, Wintershall reportedly was interested in acquiring drilling rights on the Oasis Group concessions (Middle East Economic Digest, 2001d). In September, the Government gave the American members of the Oasis Group 12 months (from September 2001) to return to work on their concessions, which were originally scheduled to expire in 2005. The Group's concessions had been maintained since 1986 by Waha Oil (a subsidiary of NOC).

The $250 million renovation of the 120,000-bbl/d Az Zawiya refinery continued (Oil & Gas Journal, 2000; Africa Energy Intelligence, 2001). Additional information on the oil and gas sector can be found in the U.S. Energy Information Administration's July 2002 Country Analysis Brief for Libya at URL http://www.eia.doe.gov/emeu/cabs/libya.pdf.

Infrastructure

The Governments of Egypt and Libya proposed to establish Arab Company for Oil and Gas Pipelines. The new company would be charged to build a pipeline system to transport Libyan crude oil to Egypt and Egyptian natural gas to Libya (Organization of Petroleum Exporting Countries, 2001). Libya also planned to build a rail system along the northern coast to connect Musaid in the east with Ras Ajdar in the west. Construction of the rail network was expected to consume 500,000 metric tons (t) of concrete sleepers and 370,000 t of steel rail. A feasibility study was underway for a spur rail line extending inland, south from Sirte (Middle East Economic Digest, 2001e).

References Cited

Africa Energy Intelligence, 2001, Libya—LG Engineering in pole position for Zawia Refinery: Africa Energy Intelligence, no. 299, May 23, p. 5.

Middle East Economic Digest, 2001a, Bids in on Elephant field: Middle East Economic Digest, v. 45, no. 41, October 12, p. 10.

Middle East Economic Digest, 2001b, Bouygues wins block NC-137 work: Middle East Economic Digest, v. 45, no. 31, August 3, p. 10.

Middle East Economic Digest, 2001c, News in brief—Libya: Middle East Economic Digest, v. 45, no. 24, June 15, p. 12.

Middle East Economic Digest, 2001d, Oasis group given one-year ultimatum: Middle East Economic Digest, v. 45, no. 37, September 14, p. 10.

Middle East Economic Digest, 2001e, Rail project full steam ahead on Libya coast: Middle East Economic Digest, v. 45, no. 21, May 25, p. 14.

Oil & Gas Journal, 2000, Industry briefs—Refining—Azzawiya Oil Refining Co.: Oil & Gas Journal, v. 98, no. 10, March 6, p. 38.

Organization of Petroleum Exporting Countries, 2001, Libya and Egypt to set up joint firm to transport oil and gas: OPEC Bulletin, v. 22, no. 9, September, p. 15-16.

Quinlan, Martin, 2002, Doubling of gas export capacity in sight: Petroleum Economist, v. 69, no. 3, March, p. 4-6.

Petro-Canada, 2002, Annual report: Calgary, Alberta, Canada, Petro-Canada, 43 p.

Townsend, David, 2002, Maybe the beginning of the end: Petroleum Economist, v. 69, no. 3, March, p. 8.

Rusk, D.C., 2000, Libya—Petroleum potential of under-explored basin centers—A 21st century challenge: Houston Geological Survey Bulletin, v. 42, no. 9, May, p. 19.

U.S. Energy Information Administration, 2002, Monthly energy review: U.S. Energy Information Administration, August, p. 146-147.

Internet References Cited

General Industrialization Corp., 2002a, Future investment projects, Guide to the Industrial Investment in Libya, accessed October 7, 2002, at URL http://www.giclibya.com/english/investment/fut_inv_proj_detail.htm.

General Industrialization Corp., 2002b, Libyan Iron & Steel Company, Guide to the Industrial Investment in Libya, accessed July 21, 2002, at URL http://www.giclibya.com/english/investment/iron_steel.htm.

General Industrialization Corp., 2002c, Mineral raw materials available for investment in Libya, Guide to the Industrial Investment in Libya, accessed July 21, 2002, at URL http://www.giclibya.com/english/investment/minral_ava.htm.

International Monetary Fund, 2002, Gross domestic product—Current prices—All countries, accessed August 2, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/02/data/index.htm.

Digitized by Google

TABLE 1
LIBYA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Thousand metric tons unless otherwise specified)

Commodity 3/		1997	1998	1999	2000	2001
Cement, hydraulic		2,524 4/	3,000	3,000	3,000	3,000
Gas, natural:						
Gross	million cubic meters	12,910 4/	12,600	12,400	12,000	12,000
Dry	do.	6,570 4/	5,800 r/	5,500 r/	5,400 r/	5,400
Gypsum		125	150	150	175	150
Iron and steel, metal:						
Direct-reduced iron 4/ 5/		990	1,010	1,330	1,500	1,090
Crude steel		897 4/	925 4/	945 4/	1,055 4/	900
Lime		275	275	270	270	250
Nitrogen: 4/						
N content of ammonia		536	545	552	552	495
N content of urea		383	408	386	407	365
Petroleum:						
Crude	thousand 42-gallon barrels	544,000	540,000	520,000	538,000	520,000
Refinery products:						
Gasoline	do.	16,200	16,800	10,000	12,000	12,000
Kerosene and jet fuel	do.	14,300	12,700	7,000	8,400	8,400
Distillate fuel oil	do.	31,500	31,800	20,000	24,000	24,000
Residual fuel oil	do.	35,500	33,600	25,000	30,000	30,000
Other	do.	18,000	20,000	13,000	15,600	15,600
Total	do.	116,000	115,000	75,000	90,000	90,000
Salt		30	30	30	40	40
Sulfur, byproduct of petroleum and natural gas		13	13	13	13	15

r/ Revised.

1/ Estimated data are rounded to no more than three significant digits; may not add to totals shown.

2/ Table includes data available through September 23, 2002.

3/ In addition to the commodities listed, a variety of brick, dolomite, limestone, methanol, crushed construction stone, and tile was produced, and natron (soda ash) may have been produced, but available information is inadequate to make estimates of output levels. Natural gas liquids also were produced but were blended with crude petroleum and reported as part of that total.

4/ Reported figure.

5/ Includes hot briquetted iron.

Digitized by Google

Digitized by Google

THE MINERAL INDUSTRY OF

MADAGASCAR

By Thomas R. Yager

The Republic of Madagascar, which is the world's fourth largest island, is about 420 kilometers (km) east of Mozambique in the Indian Ocean. Its mining industry has been chiefly noted for the production and export of chemical- and metallurgical-grade chromite ore, high-quality crystalline flake graphite, and mica. In addition to these minerals, small quantities of beryllium, gold, and rare earths have been produced, as well as industrial mineral commodities, which included cement, feldspar, ornamental stones, precious and semiprecious gemstones, quartz, and salt. Madagascar was also known to have deposits of bauxite, coal, copper, lead, manganese, nickel, platinum, tin, titanium, zinc, and zirconium.

In 2001, Madagascar's gross domestic product (GDP) amounted to about $17.5 billion at purchasing power parity, and per capita income was about $1,100. At current market prices, the GDP was $4.6 billion. Industry accounted for about 12% of the GDP in 2001. Madagascar's GDP increased by 6.7% in 2001 after rising by 4.8% in 2000, 4.7% in 1999, and 3.9% in 1998 (International Monetary Fund, 2002, p. 174; 2003, p. 46; 2002a§[1]-c§).

Output in the mining sector has been volatile in recent years. In 1997, 1999, and 2001, the mining sector contracted by 10.7%, 39.7%, and 0.6%, respectively. In 1998 and 2000, output increased by 16.8% and 45.3%, respectively. The volatility in mining sector output was probably the result of fluctuating production of chromite and graphite (table 1). In 2001, the sharp decline in chromite and graphite production was mostly offset by rising output of ruby and sapphire. From 1996 to 2001, the mining sector contracted by an average of about 1.9% per year. During the same period, the construction materials sector grew by 5.8% per year (International Monetary Fund, 2003, p. 53).

Government Policies and Programs

In 2001, the International Monetary Fund and the World Bank announced plans to assist Madagascar in reforming its mining sector. The proposed 5-year reform program would increase supervision of the artisanal mining sector, assist gemstone cutting and polishing centers, and update geologic data. The reforms would also set up special economic activity zones to supervise the sale of gemstones, to decentralize the management of mineral resources to provinces and municipalities, and to encourage foreign assistance by backing pilot projects. A World Bank loan for the project could be approved by June 2002 (Africa Mining Intelligence, 2001c).

Reforms to Madagascar's mining laws enacted in 1999 and 2000 arrange stepwise permitting. The first step is the prospecting permit, which is valid for 3 months and does not allow drilling or pitting. The next step is the exclusive exploration permit, which is valid for 3 months and guarantees an exploration license upon request. Exploration licenses are exclusive licenses granted for 10 periods and are renewable once for an additional 5 years. A closure plan, an environmental study, a reclamation plan, and other steps are required with the application for an exploration license. Mining permits are valid for 40 years with time limits to bring the property into production and are renewable several times in 20-year increments. Royalties of 2% are charged on production, and import duties are 10% of the value of the item imported (Cope, 2002).

In December 2001, the National Assembly passed legislation aimed at attracting large-scale mining projects. The import duty on capital goods was cut to 1% from 10%. The corporate income tax was cut to 25% from 35% and to 10% if value is added to a product. The property tax was also reduced and an investment tax credit was enacted (Cope, 2002).

Commodity Review

Metals

Beryllium.—Madagascar's largest beryl deposits are found at Ambatofinadrahana, Ampandramaika Malakialina, and Tsaratanana. Other deposits include Betafo Antsirabe, Itrongay, and Miandrivazo. Madagascar's production of beryllium fell sharply in 2000 and 2001 (table 1); this decline reflected the 50% decrease in world beryllium production between 1998 and 2001 (Cunningham, 2002).

Chromium.—Kraomita Malagasy (KRAOMA) produced concentrates (49% chromite) and lumpy ore (42% chromite) from the mine at Ankazotaolana. The company planned to reopen its mine at Bemanevika owing to resource depletion at the Ankazotaolana mine by mid-2004. In 2001, production fell to 51,900 t from 118,750 t in 2000 (table 1); the decrease may have been attributable to weakness in the market for stainless steel. Madagascar's chromite exports fell to 91,800 t in 2000 from 110,100 t in 1996 (Indian Ocean Newsletter, 2001; International Monetary Fund, 2001, p. 71).

Cobalt and Nickel.—Substantial resources of cobalt and nickel are found at the Ambatovy lateritic deposit. Extensive nickel laterites also occur on the east coast between Fenoarivo and Mananjary. Phelps Dodge Corp. planned to develop

[1]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

Ambatovy into a 36,000-metric-ton-per-year (t/yr) nickel and 3,000-t/yr cobalt mine and to refine the nickel and cobalt by high-pressure acid leaching. Capital expenses, which included infrastructure and power supply, to develop the Ambatovy deposit were estimated to be $1.1 billion. At the end of 2001, the project awaited higher metal prices, the finalization of funding, and the resolution of permitting and regulatory issues (Cope, 2002; Phelps Dodge Corp., 2002, p. 11).

Gold.—Numerous deposits of gold, which include those at Ampanihy, Andavakoera, Farafangana, Maevatanana, and Miandrivazo, occur in Madagascar. About 100,000 artisanal miners produced gold from small high-grade deposits that have not yet attracted the interest of major mining companies. Officially reported gold production declined to insignificant levels in 2001 (table 1); the country's actual gold production has been estimated to be from about 3 to 4 t/yr (Crankshaw, 2001).

Titanium and Zirconium.—Madagascar is known to have substantial deposits of titanium and zirconium. Phelps Dodge engaged in exploration for titanium and zirconium at an ilmenite deposit at Ankafero in the Toamasina region. In November 2001, the Government granted QIT-Madagascar Minerals SA (QMM) an environmental permit for the Mandena, Petriky, and Ste. Luce deposits near Tolagnaro; QMM's plans to mine these deposits have been controversial for environmental reasons. The company planned to produce about 700,000 t/yr of ilmenite and 33,000 t/yr of zircon. QMM planned to start the 3-year construction process after completing a final feasibility study. The cost to bring the project to production was expected to be $350 million (Africa Mining Intelligence, 2001b; Premoli, 2001; Cope, 2002).

Industrial Minerals

Cement.—Holcim Group held a 90% share in SOMACIM, which operated a cement plant with a clinker grinding capacity of 150,000 t/yr at Ibity. SA Nouvelle Cimenterie Amboanio (66% owned by the Lafarge Group) operated a plant at Mahajanga with a clinker grinding capacity of 40,000 t/yr. National cement production increased to 50,938 metric tons (t) in 2000 from 36,217 t in 1997 (tables 1, 2). In recent years, Madagascar has imported cement from Malaysia and Oman.

Gemstones.—Madagascar is known to have deposits of many types of gemstones, such as emerald at Mananjary, ruby at Andilamena and Vatomandry, sapphire at Ilakaka and Manditsara, and tourmaline at Anjanabonoina. Such semiprecious stones as amethyst, aquamarine, citrine, garnet, and sphene and such ornamental stones as agate, aragonite, jasper, labradorite, and rose quartz were also produced. Most of Madagascar's gemstones were produced by artisanal miners. In 2001, the production of amethyst, aquamarine, garnet, sphene, and tourmaline fell because miners stopped work on these gemstones and moved to the newly discovered ruby deposits at Andilamena and Vatomandry (Henricus, 2001).

In the first half of 2001, between 30,000 and 40,000 miners were estimated to be working at Andilamena, which is in north-central Madagascar. Most of the ruby recovered at Andilamena was exported to Sri Lanka and Thailand. The rubies produced at the Vatomandry deposit, which is near the eastern coast of Madagascar, were higher quality than those at the Andilamena deposit (Henricus, 2001; Leuenberger, 2001).

In February 2001, the Government closed the Vatomandry deposit to mining to prevent the environmental, health, and smuggling problems that resulted from unregulated mining at Ilakaka in 1999 and 2000. Enforcement of the closure has been partially successful. The Government planned to have a mixture of artisanal and commercial mining at Vatomandry, which it divided into claims that covered 6.25 square kilometers each. The minimum bid was to be about $30,000, and candidates would be required to perform a 6- to 10-month environmental impact study before starting mining operations (Africa Mining Intelligence, 2001a; Henricus, 2001; Leuenberger, 2001).

In 2001, the Canadian company North Fork 14 Investment Group entered into a joint venture with Platinum Works Inc. and Société Les Pierres Precieuses de Madagascar to mine sapphires and other gemstones in the Ilakaka area. The mine was expected to have a life of 10 years (Stone, 2001§). Other companies that mined sapphire included Compagnie des Gemmes de Madagascar and Société Mining Discovery.

In August 2001, Madagascar established diplomatic relations with Sri Lanka. Officials from the two Governments discussed the possibility of Sri Lanka providing lapidary training to trainees from Madagascar. In September, the Sri Lankan company Radiant Gems International Ltd. began assisting in cat's eye, ruby, and sapphire mining operations in Madagascar. The company planned to cut large volumes of gemstones from its mines starting in December (Aboosally, 2001; Jewellery News Asia, 2001a).

Most of Madagascar's precious gemstone exports were rough stones; small quantities of emerald, ruby, and sapphire were cut locally by such companies as Société GERADEX and Société Gem's Desing S.A.R.L. Large quantities of ornamental stones, which included black tourmaline, blue calcite marble, celestite geodes, jasper, labradorite, opaque blue corundum, rock crystal, rose quartz, and smoky quartz, were cut in Madagascar. Madagascar Treasures cut ornamental stones in Antananarivo (Laurs, 2000).

Graphite.—Substantial deposits of graphite occurred in the Ambatolampy, Ampanihy, and Manampotsy districts. The country's largest producer of graphite was Etablissements Gallois, which had three mines in Ambalafotaka, Antsirakambo, and Marovintsy and a plant in Toamasina. Other companies mining graphite included Etablissements Izouard, Etablissements Rostaing, Société Louys, and Société Minière de la Grande Ile. Madagascar's graphite exports fell to 13,700 t in 2000 from 14,300 t in 1996 (International Monetary Fund, 2001, p. 71).

Mica.—The Ampandrandava mica deposit was mined by Société des Mines D'Ampandrandava S.A., and the Maniry Miary deposit, by Exploitation Miniere DELORME. Madagascar's production of mica declined sharply in 1999 and

Digitized by Google

only recovered slightly in 2000 and 2001 (table 1). The decrease in production was partially attributable to improved technology in other mica-producing countries, such as Canada and the United States, and the development of substitutes for mica in electronic applications (Fonds d'Appui au Secteur Prive, 2001§).

Quartz.—Deposits of industrial quartz occur at Kandreho, Mananara, and Maroantsetra; the Kandreho deposit was mined by Rollmine S.A.R.L. and the Mananara and Maroantsetra deposits were mined by Prospection & Exploitation Minère S.A. Rose quartz was found at Ampandramaika, Andrianampy, and Samiresy. Exports of quartz and quartzite increased to 586 t in 1999 from 79 t in 1995 (International Trade Center and United Nations Statistics Division, 2001).

Salt.—Madagascar's production of salt declined to 25,530 t in 2000 from 36,763 t in 1997 (table 1). Salt producers included Compagnie Saliniere de Madagascar, Grand Salins du Menabe, Salin du Menabe, Salines d'Ifaty, Sel de Belo Sur Mer, and Sels Marins d'Ampataka.

Mineral Fuels

Petroleum.—Madagascar did not produce crude petroleum and relied on imports for its refinery. The value of petroleum imports amounted to $125 million in 2000. From 1996 to 2000, petroleum imports increased to 19.2% of total imports from 14% of total imports. During the same period, exports of petroleum increased to 163,200 t from 121,800 t (International Monetary Fund, 2001, p. 71).

Madagascar's petroleum refinery had a capacity of 15,000 barrels per day and was operated by Galana International, Groupe Trimeta, Gulf Oil Corporation, and Petroleum India International. In July 2000, this group of companies took over operations from Solitany Malagasy, which was a state-owned company (Africa Energy Intelligence, 2001d). From 1997 to 2000, the refinery operated at an average of 60% of its rated capacity (tables 1, 2).

In March 2001, Vanco Madagascar (a subsidiary of Vanco Energy Company) signed a production-sharing agreement (PSA) with the Office National des Mines et des Industries Stratégiques (OMNIS). Vanco will explore for petroleum in the Majunga block, which is off the northwestern coast of Madagascar. Madagascar Hunt Oil Company and Xrponet Resources Inc. also had PSAs with OMNIS (Africa Energy Intelligence, 2001c; Oil & Gas Journal, 2001).

Infrastructure

The International Monetary Fund (2003, p. 59) estimated that Madagascar produced 833.9 gigawatthours (GWh) of electricity in 2001; this was an increase from 779.8 GWh in 2000 and 616.3 GWh in 1997. Hydroelectric power sources provided 67.6% of the country's electricity and fossil fuel sources accounted for the remaining 32.4%. From 1997 to 2001, consumption of electricity increased to 644.2 GWh from 485.4 GWh.

The electric power industry was dominated by Jiro Sy Rano Malagasy, which was Madagascar's state-owned electric utility. In 2001, the Government announced that power generation would be opened to the private sector; transmission and distribution would remain under state control (Africa Energy Intelligence, 2001a).

In 2001, the Government announced invitations to tender for the construction of four hydroelectric plants at Ambositra, Antsirabe, Mahajnaga, and Toamasina. Hydelec S.A.R.L. won contracts to build and operate five small hydroelectric stations with a combined capacity of 24.3 megawatts (MW) and a wind energy facility with a capacity of 1.2 MW. Hydelec hoped to raise the $34.2 million needed for this project by the end of 2003 (Africa Energy Intelligence, 2001b).

Madagascar had about 50,000 km of roads, of which approximately 5,800 km was paved; the rail network covered nearly 900 km. The country's infrastructure was in need of major repairs and expansion; its inadequacy has been a key factor in preventing the development of Madagascar's bauxite, coal, and iron ore deposits.

Outlook

Demand for cement and other construction materials depended on the strength of the domestic economy. The International Monetary Fund (2002, p. 174) predicted that Madagascar's GDP would decline by 10% in 2002 and increase by 10% in 2003; the civil unrest in the wake of the disputed presidential election was expected to have substantial effects upon the economy in 2002.

Madagascar's domestic instability could also have an effect upon the production of the beryl, chromite, gemstone, gold, graphite, and mica industries, which depend heavily upon world market conditions. In 2003, world beryllium consumption was expected to rise by 2%. The demand for chromite is tied to the stainless steel market, which was expected to show little growth in 2002 and to grow by 5% to 6% in 2003. In general, gemstone sales were expected to remain stable or to show a slight increase in 2002. Modest decreases in gold mine production by 2003 were likely to be offset by falling demand (Jewellery News Asia, 2001b; Metal Bulletin, 2001; SG Securities Ltd., 2001, p. 22; Cunningham, 2002).

Demand for Madagascar's unexploited mineral commodities will also depend upon world market conditions. Nickel prices were likely to rise; demand was expected to increase by 11% from 2001 to 2003, and mine capacity, by 5%. Global demand for rare-earth oxides was expected to increase to 100,000 t in 2005 from 74,000 t in 1999. Demand for titanium dioxide (TiO_2) pigment is expected to increase by about 3% to 4% per year from 2002 to 2006. About 95% of all titanium minerals are consumed to produce TiO_2 pigment (Gambogi, 2001; SG Securities Ltd., 2001, p. 18; Chegwidden and Kingsworth, 2002).

References Cited

Aboosally, Sharm, 2001, Sri Lankan polishers assist in mining in Madagascar: Jewellery News Asia, no. 206, October, p. 60.

Digitized by Google

Africa Energy Intelligence, 2001a, Madagascar—End to power monopoly: Africa Energy Intelligence, no. 299, May 23, p. 7.
Africa Energy Intelligence, 2001b, Madagascar—Major outlay for power plants: Africa Energy Intelligence, no. 299, May 23, p. 6.
Africa Energy Intelligence, 2001c, Madagascar—New exploration push: Africa Energy Intelligence, no. 300, June 6, p. 3.
Africa Energy Intelligence, 2001d, Madagascar—Solima privatized at last: Africa Energy Intelligence, no. 300, June 6, p. 3-4.
Africa Mining Intelligence, 2001a, Madagascar—New precious stones license: Africa Mining Intelligence, no. 15, May 30, p. 1.
Africa Mining Intelligence, 2001b, Madagascar—Way clear for nickel project: Africa Mining Intelligence, no. 15, May 30, p. 2.
Africa Mining Intelligence, 2001c, Madagascar—World Bank to help 2nd wave of reforms: Africa Mining Intelligence, no. 26, November 21, p. 1.
Chegwidden, Judith, and Kingsnorth, D.J., 2002, Rare earths supply and demand—A European market focus: Industrial Minerals, no. 415, April, p. 52-61.
Cope, L.W., 2002, Madagascar mining—Open for business: Engineering & Mining Journal, v. 203, no. 4, April, p. 24-28.
Crankshaw, Paul, 2001, Madagascar, *in* Mining annual review 2001: London, United Kingdom, Mining Journal Ltd. CD-ROM.
Cunningham, L.D., 2002, Beryllium, *in* Metals and minerals: U.S. Geological Survey Minerals Yearbook 2001, v. I, p. 11.1-11.7.
Gambogi, Joseph, 2001, Titanium: Engineering & Mining Journal, v. 202, no. 4, April, p. 50-52.
Henricus, Jennifer, 2001, New Madagascan ruby finds trigger mining rush: Jewellery News Asia, no. 202, p. 72-82.
Indian Ocean Newsletter, 2001, Madagascar—Kraomita Malagasy projects: Indian Ocean Newsletter, no. 933, January 13, p. 4.
International Monetary Fund, 2001, Madagascar—Selected issues and statistical appendix: Washington, DC, International Monetary Fund, December 13, 75 p.
International Monetary Fund, 2002, World economic outlook—Trade and finance: Washington, DC, International Monetary Fund, September 25, 235 p.
International Monetary Fund, 2003, Madagascar—Selected issues and statistical appendix: Washington, DC, International Monetary Fund, January 8, 88 p.
International Trade Center and United Nations Statistics Division, 2001, Trade analysis system on personal computer: New York, International Trade Center and United Nations Statistics Division CD-ROM.
Jewellery News Asia, 2001a, Formal ties between Sri Lanka and Madagascar expected to benefit gemstone sector, trade says: Jewellery News Asia, no. 207, November, p. 82.
Jewellery News Asia, 2001b, Gemstone sales may be stable or up slightly: Jewellery News Asia, no. 208, December, p. 72.
Laurs, Brendan, 2000, Visit to a Malagasy lapidary facility: Gems & Gemology, v. 36, no. 3, Fall, p. 267-268.
Leuenberger, Alexander, 2001, The new ruby deposits in eastern Madagascar—Mining and production: Gems & Gemology, v. 37, no. 2, summer, p. 147-149.
Metal Bulletin, 2001, ISSF told not to expect recovery in demand until 2003: Metal Bulletin, no. 8573, May 10, p. 22.
Oil & Gas Journal, 2001, Quick takes: Oil & Gas Journal, v. 99, no. 32, August 6, p. 8-9.
Phelps Dodge Corp., 2002, Annual report on Form 10-K for the year ended December 31, 2001: Phoenix, Arizona, Phelps Dodge Corp., 91 p.
Premoli, Camillo, 2001, Madagascar, *in* Mining annual review 2000: London, United Kingdom, Mining Journal Ltd. CD-ROM.
SG Securities Ltd., 2001, A mountain to climb: Quarterly Metals Review, October, 28 p.

Internet References Cited

Fonds d'Appui au Secteur Privé, 2001, Mining sector of Madagascar—Gold, precious stones, semi-precious stones, and ornamental stones, accessed July 23, 2001, at URL http://www.madagascar-contacts.com/fasp/Sec_Mines/BDSMines_B2_21.htm.
International Monetary Fund, 2002a (April), Gross domestic product at current prices—All countries, World Economic Outlook Database, accessed August 14, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/01/data/ngdpd_a.csv.
International Monetary Fund, 2002b (April), Selected world aggregates, World Economic Outlook Database, accessed June 10, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/01/data.
International Monetary Fund, 2002c (April), Shares of aggregate GDP based on purchasing power parity (PPP) valuation of country GDP—Developing countries, World Economic Outlook Database, accessed June 10, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/01/data.
Stone, Martin, 2001, Venture to mine large-scale in Madagascar, accessed April 4, 2002, at URL http://www.colored-stone.com/stories/sep01/madagascar.cfm.

Digitized by Google

TABLE 1
MADAGASCAR: PRODUCTION OF MINERAL COMMODITIES 1/

(Kilograms unless otherwise specified)

Commodity 2/		1997	1998	1999	2000	2001 e/
METALS						
Beryllium, beryl in quartz concentrates, industrial and ornamental		28,287	30,000	20,000 r/ e/	1,696 r/	1,000
Chromium, marketable output:						
Chromite concentrate, gross weight	metric tons	45,000	19,000	--	21,600	9,400
Chromite ore, lumpy	do.	94,700	85,300	--	97,150 r/	42,500
Total	do.	139,700	104,300	--	118,750 r/	51,900 3/
Gold, mine output, Au content 4/		8	12	8 e/	5 r/	(5/) p/
INDUSTRIAL MINERALS						
Abrasives, natural (industrial only) e/		1,314 3/	1,500 r/	900 r/	1,300 r/	1,300
Cement, hydraulic	metric tons	36,217	44,327	45,719	50,938 r/	53,500
Clay, kaolin e/	do.	166 3/	200 r/	120 r/	170 r/	170
Feldspar		-- r/	5,600 r/ e/	3,400 r/ e/	7,300 r/	2,800 p/
Gemstones: 6/						
Emerald		1	1	2 7/	6 7/	6
Ruby		21	31	6 7/	3	941 p/
Sapphire		3,957	2,874	3,810 7/	471	8,470 p/
Tourmaline		1,936	1,286	1,400 e/	1,989	800
Graphite, all grades, shipments	metric tons	14,107 r/	20,629 r/	16,137 r/	40,328 r/	2,013 p/
Mica, phlogopite:	do.	1,529 r/	1,232 r/	54 r/	66 r/	90 p/
Ornamental stones: 6/						
Agate		66,600	117,250	75,000 e/	49,675	25,000
Aragonite		589,050	1,781,550	1,300,000 e/	821,000 e/	343,000
Jasper		78,630	39,070	41,000 e/	43,000 e/	45,700
Labradorite		176,300	208,600	174,000 e/	139,000 e/	103,000
Rose quartz 8/		13,695	127,182	30,000 e/	6,200	10,792 p/
Salt, marine	metric tons	36,763 r/	26,746 r/	26,131 r/	25,530 r/	26,000
Semiprecious stones: 6/						
Amethyst		66	57	100 e/	156	75 p/
Citrene		268	78	135 e/	210 e/	100
Garnet		93	14	25 e/	45 e/	20
Sphene		1	7	10 e/	10 e/	5
Stone:						
Dimension stone	do.	2,740 7/	1,878 7/	138 r/ 7/	200 r/ e/	200
Marble	do.	NA	NA	NA	1,222	5,600 p/
MINERAL FUELS AND RELATED MATERIALS						
Petroleum refinery products:						
Gasoline	thousand 42-gallon barrels	647 r/	583	617	771 r/	770
Kerosene and jet fuel	do.	480 r/	474	409	410 r/	410
Distillate fuel oil	do.	811 r/	697	749	946 r/	950
Residual fuel oil	do.	1,300 r/	1,370	1,251	1,420 r/	1,400
Other	do.	68 r/	49	61	75 r/	70
Total	do.	3,306 r/	3,173	3,087	3,622 r/	3,600

e/ Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. p/ Preliminary. r/ Revised. NA Not available. -- Zero.

1/ Includes data available through August 16, 2002.

2/ In addition to the commodities listed, modest quantities of unlisted varieties of crude construction materials (other clays, sand and gravel, and stone) and industrial calcite presumably were produced, but output was not reported quantitatively, and available information was inadequate to make reliable estimates of output levels.

3/ Reported figure.

4/ Does not include smuggled artisanal production, which was estimated to be 3,000 to 4,000 kilograms per year.

5/ Less than 1/2 a unit.

6/ Does not include smuggled artisanal production.

7/ Exports.

8/ In recent years, Madagascar has also produced industrial quartz. The most recently reported production for all types of quartz in 1997 was 166 metric tons.

Digitized by Google

TABLE 2
MADAGASCAR: STRUCTURE OF THE MINERALS INDUSTRY IN 2001

(Metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Cement		SOMACIM (Holcim SA, 90%)	Ibity	150,000.
Do.		SA Nouvelle Cimenterie Amboanio (LaFarge Group, 66%; Moustansir Ibaramdty Family, 34%)	Mahajanga	40,000.
Chromite		Kraomita Malagasy (Government, 100%)	Ankazotaolana	250,000 run of mine.
Do.		do.	Bemanekiva	40,000 run of mine.
Graphite 1/		Etablissements Gallois	Toamasina	10,000 processed.
Do.		Etablissements Izouard		NA.
Do.		Etablissements Rostaing		NA.
Do.		Societe Louys		NA.
Do.		Societe Miniere de la Grande Ile	Ambatomitamba	10,000 processed.
Mica		Societe des Mines d'Ampandranhava	Tolagnaro	2,000 processed.
Petroleum, refined	thousand barrels	Galana International, Groupe Trimeta, Gulf Oil Corporation, and Petroleum India International	Toamasina	5,475.

NA Not available.
1/ Total capacity of graphite is at least 40,000 metric tons per year based on recent production data.

Digitized by Google

THE MINERAL INDUSTRIES OF

MOROCCO AND WESTERN SAHARA

By Philip A. Szczesniak

MOROCCO

The mineral industry of Morocco was dominated by phosphate mining in 2001; Morocco was the world's second largest producer of phosphate rock after the United States in 2001 (Jasinski, 2002); about 22 million metric tons of phosphate rock was mined. Morocco also mined a wide range of minerals that included barite, coal, cobalt, copper, fluorspar, gold, iron ore, lead, manganese, salt, silver, and zinc and had a significant capacity for conversion of phosphate rock into fertilizer. The gross domestic product was estimated on the basis of purchasing power parity to be about $112.18 billion in 2001. Agriculture was the dominant industry. Exports in 2000 were $7.3 billion led by $1.5 billion worth of agricultural products; phosphate was the leading mineral export at $431 million. Morocco's population was estimated to be 28.7 million in 2001 (World Bank, 2001§[1]; International Monetary Fund, 2002§).

The Government agency responsible for overseeing the mining industry of Morocco is the Ministère de l'Energiè et des Mines. Several state-owned organizations play a direct role in mineral-resource development. The Bureau de Recherches et de Participations Minières (BRPM) is responsible for the development of most mineral resources. La Centrale d'Achat et de Developpment de la Region Minière de Tafilalet et de Figuig was formed to promote and support the interests of artisanal miners in the Tafilalet and Figuig regions. The Office Cherifien des Phosphates (OCP) is responsible for managing and controlling all aspects of phosphate mining and beneficiation (MBendi Information Services (Pty.) Ltd., 2001a§).

The Office National de Recherches et d'Exploitations Petrolieres (ONAREP) is responsible for overseeing the energy sector. During 2000, the ONAREP made changes to petroleum laws to encourage more investment. More specifically, new petroleum laws included a 10-year tax holiday after first production for offshore operators and a reduction in royalty payments to 10% for onshore and shallow water producers and to 7% for deepwater producers (World Oil, 2000; MBendi Information Services (Pty.) Ltd., 2001b§).

In 2001, Morocco produced 1,190 kilograms (kg) of gold. Akka Gold Mining Company [jointly owned by Holding Minier du Groupe ONA (Managem) of Morocco (70%) and the BRPM (30%)] operated the gold mine at Iourim in southern Morocco. The mine was estimated to have reserves of 34,000 kg of gold. In 2001, Managem announced that it had received a loan for $28.5 million from the European Investment Bank to fund the development of the mine. Also in 2001, Managem signed an agreement with La Société de Promotion et de Participation pour la Coopération Économique (Proparco) (a subsidiary of Agence Francaise de Developpement) for a $20 million loan to help fund the mine (Africa Energy & Mining, 2000a; Middle East Economic Digest, 2001).

In 2000, the Société Nationale de Sidérurgie launched the construction of a new industrial plant that was expected to produce concrete steel-reinforcement bars and hot-rolled metal sections. The 300,000-metric-ton-per-year (t/yr)-capacity rolling mill, which covers an area of 25 hectares inside the Jorf Lasfar industrial area, was expected to start production in 2002 at a cost of $60 million (Metal Bulletin, 2000; Morocco Ministry of Communications, 2000§).

Morocco produced about 8.5 million metric tons (Mt) of cement in 2001; this was an increase of nearly 5% compared with the 8.1 Mt of cement in 2000. The leading companies operating in Morocco were Lafarge Ciments of France, Ciments du Maroc (controlled by Italcementi of Italy), Ciments de l'Oriental (controlled by Holderbank of Switzerland), and Asmet de Temara (controlled by Cimentos de Portugal). In 2000, Managem and Lafarge Ciments announced a joint venture to build a 960,000-t/yr-capacity cement plant in the northern Moroccan city of Tetuan. The plant would cost $120 million and was anticipated to begin operating by 2003. They also noted that the plant would help meet Moroccan cement needs, which they estimated would grow to 15 Mt from 7 Mt by 2015 (Arabicnews.com, 2000§).

In 2001, phosphate rock production in Morocco increased to about 22.0 Mt from about 21.5 Mt in 2000; amounts include phosphate rock production in Western Sahara, which was estimated to be 1.5 Mt for both years. In April, OCP officials announced that they intended to invest about $780 million to expand operations and to build additional cargo ships during the next 5 years. Furthermore, they noted that they would continue to develop value-added derivatives, such as phosphoric acid and fertilizers (Actualités Presse, 2001b§). In 2001, phosphoric acid production was about 2.8 Mt, and production of fertilizers was about 2.0 Mt.

Petroleum exploration or prospecting licenses in force in 2001 were held by the ONAREP or by joint ventures of the ONAREP and international companies, which included Conoco Ltd. of the United Kingdom, Energy Africa Ltd. of South Africa, Enterprise Oil Exploration Ltd. of the United Kingdom, Kappa Energy Co. Ltd. of Canada (formerly Cabre Exploration Ltd.), Kerr-McGee Corp. of the United States, Lasmo Overseas Nederland (II) B.V. of the Netherlands, Shell Prospecting Africa B.V., Lone Star Energy (a subsidiary of Skidmore Energy Inc. of the United States), Taurus Petroleum AB of

[1]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

Sweden, and Vanco Energy Co. of the United States (Arab Petroleum Research Center, 2001, p. 283). In 2000, Lone Star Energy announced that it had discovered oil and gas in Talsinnt, which is a region in the High Atlas Mountains of northeastern Morocco 200 kilometers (km) from the Algerian border. Although original estimates of potential reserves were later revised down to much lower levels than originally estimated, the news drew significant international attention (Africa Energy & Mining, 2000b; Financial Times, 2000; Middle East Economic Digest, 2000). In 2001, additional exploration licenses were awarded to nearly all the above-mentioned companies.

Besides the Talsinnt region, exploration was ongoing in seven other regions—the Loukos South Offshore block in the Atlantic Ocean north of Rabat, the Al Hoceima-Nador Offshore area in the Mediterranean, the Cap Draa Haute Mer Offshore area south of Agadir, an offshore block south of Rabat, a block at Labrouj in the center of the country, an area around Ounoura on the Atlantic coast near Essaouira, and five deepwater blocks on the Atlantic coast south of Agadir (U.S. Energy Information Administration, 2001§).

Morocco's major oil distributor was the Société Anonyme Marocaine de l'Industriele Raffinage (SAMIR). In 2000, SAMIR was engaged in a $400 million investment project to upgrade its refining capabilities. When the upgrade is complete, SAMIR will have a capacity of 140,000 barrels per day (Washington Times, 2000§).

In February 2001, CMS Energy Corp. of the United States announced that commercial operation had been achieved at Unit 4 of its $1.5 billion 1,356-megawatt Jorf Lasfar powerplant that is located 126 km southwest of Casablanca on the Atlantic coast of Morocco. The Jorf Lasfar facility will generate more than one-half of Morocco's total electricity supply by using coal and is considered to be the largest independent powerplant in Africa. CMS Energy has been supplying power to the Office Nationale de l'Electricité (the Moroccan national utility) (CMS Energy Corp., 2001§).

In January 2001, the Office National des Chemins de Fer du Maroc announced plans to spend $162 million in 2001 on upgrading the country's railway network. Specifically, an extra track will be laid between Meknes and Fez, and port stations at Ain Sbaa and Casablanca will be refurbished. The project, which was launched in 2000, was part of a 4-year $650 million plan primarily to deal with handling increased ridership by tourists and the needs of the phosphate industry. The project was being financed by the European Investment Bank and the Japanese Bank for International Cooperation (Actualités Presse, 2001a§).

WESTERN SAHARA

The mineral industry of Western Sahara was dominated by phosphate mining in 2001, producing an estimated 1.5 Mt. The open pit phosphate rock mine at Bou Craa was operated by the OCP. Western Sahara's economy is dependent on agriculture, fishing, and phosphate mining. All trade and economic activities are controlled by the Moroccan Government. Western Sahara's population was estimated to be about 250,000 in 2001 (U.S. Central Intelligence Agence, 2001§).

In late 2001, the ONAREP awarded oil exploration permits for Western Sahara's entire offshore area to TotalFinaElf of France and Kerr-McGee. In protest, the Sahrawi government wrote to the United Nations (UN) concerning the matter. The UN was expected to issue a ruling on the dispute sometime in 2002 (Africa Energy Intelligence, 2001; Afrol news, 2002§).

References Cited

Africa Energy & Mining, 2000a, Morocco—New mine at Akka: Africa Energy & Mining, September 13, no. 282, p. 6.

Africa Energy & Mining, 2000b, Talsinnt—Realism after euphoria: Africa Energy & Mining, August 30, no. 281, p. 1.

Africa Energy Intelligence, 2001, Morocco—Western Sahara oil for TotalFinaElf: Africa Energy Intelligence, October 3, p. 3.

Arab Petroleum Research Center, 2001, Morocco, *in* Arab oil & gas directory: Paris, France, Arab Petroleum Research Center, p. 279-294.

Financial Times, 2000, Oil and gas finds raise Moroccan hopes: Financial Times [London, United Kingdom], August 25, p. 6.

Jasinski, S.M., 2002, Phosphate rock: U.S. Geological Survey Mineral Commodity Summaries 2002, p. 122-123.

Metal Bulletin, 2000, Moroccan works plans new bar and section mill: Metal Bulletin, no. 8456, March 6, p. 19.

Middle East Economic Digest, 2000, Morocco claims major find: Middle East Economic Digest, v. 44, no. 35, September 1, p. 10.

Middle East Economic Digest, 2001, Morocco—Managem gets loan from EIB: Middle East Economic Digest, v. 44, no. 3, January 19, p. 22.

World Oil, 2000, Others—Morocco: World Oil, v. 221, no. 8, August, p. 90.

Internet References Cited

Actualités Presse, 2001a (January 26), Morocco plans to spend $162 mln in 2001 on upgrading railway, accessed May 15, 2001, at URL http://www.aim.net.ma/Jan26201.htm.

Actualités Press, 2001b (April 23), Morocco to invest $780 million in phosphate industry through 2005, accessed September 10, 2002, at URL http://www.aim.net.ma/Apr23101.htm.

Afrol News, 2002 (January 23), Western Sahara—UN to rule on Moroccan oil deal in Western Sahara, accessed September 10, 2002, at URL http://www.afrol.com/News2002/wsa003_mor_oildeal.htm.

Arabicnews.com, 2000 (January 15), Moroccan and French firms to invest $120 million in cement plant, accessed September 25, 2001, at URL http://www.arabicnews.com/ansub/Daily/Day/000115/2000011526.html.

CMS Energy Corp., 2001 (February 9), CMS Energy Corp. announces commercial operation of unit 4 at Jorf Lasfar powerplant in Morocco, accessed September 26, 2001, at URL http://www.consumersenergy.com/apps/NewsArticleCMS.asp?ID=817.

International Monetary Fund, 2002 (April), World economic outlook database, accessed June 12, 2002, at URL http://www.imf.org/external/pubs/ft/weo/2002/01/data.

MBendi Information Services (Pty.) Ltd., 2001a (April 24), Morocco—Mining—Overview, accessed September, 19, 2001, at URL http://www.mbendi.co.za/indy/ming/af/mo/p0005.htm.

MBendi Information Services (Pty.) Ltd., 2001b (July 12), Morocco—Oil and gas industry, accessed September, 25, 2001, at URL http://www.mbendi.co.za/indy/oilg/af/mo/p0005.htm.

Morocco Ministry of Communications, 2000 (September), King Mohammed VI launches construction materials unit plant, accessed September 24, 2001, at URL http://www.mincom.gov.ma/news/2000/2509to3009/roy/roy.htm.

U.S. Central Intelligence Agency, 2001, Western Sahara, World Factbook 2001, accessed September 18, 2002, at URL http://www.odci.gov/cia/publications/factbook/geos/wi.html.

U.S. Energy Information Administration, 2001 (January), Morocco, Country Analysis Brief, accessed September 26, 2001, at URL http://www.eia.doe.gov/emeu/cabs/morocco.html.

Washington Times, 2000 (November 27), Oil served on a silver platter, accessed March 27, 2001, at URL http://www.internationalspecialreports.com/africa/00/morocco/12.html.

World Bank, 2001 (September 20), Morocco at a glance—2000, accessed February 28, 2002, via URL http://www.worldbank.org/data/countrydata/countrydata.html#AAG.

Digitized by Google

Major Sources of Information

Direction des Mines
Rabat-Institute Haut Agdal
B.P. 6208
Rabat, Morocco
Telephone: (212) (7) 77-28-46
Fax: (212) (7) 77-79-42

Direction de la Geologie
Rabat-Institute Haut Agdal
B.P. 6208
Rabat, Morocco
Telephone: (212) (7) 77-28-24
Fax: (212) (7) 77-79-43

Ministry of Industry, Trade, Energy, and Mines
Rabat-Institute Haut Agdal
B.P. 6208
Rabat, Morocco

TABLE 1
MOROCCO AND WESTERN SAHARA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1997	1998	1999	2000	2001
METALS						
Antimony concentrate:						
Gross weight		350 e/	350 e/	600 r/	-- r/	--
Sb content		160	160 e/	250 r/	-- r/	--
Cobalt concentrate:						
Gross weight		7,137	2,874	9,488	14,341	14,000 e/
Co content		714	287	863	1,305	1,300 e/
Cobalt recovered from tailings		220 e/	242	472	967 r/	1,337
Copper:						
Concentrates, gross weight		37,344	26,780	25,260	23,150	19,120
Matte, gross weight		2,682	2,841	2,212	2,117	1,580
Cu content, concentrates and matte		14,000 r/	8,200	7,747	7,080 r/	5,800
Gold e/	kilograms	450	450	--	505 r/ 3/	1,190 3/
Iron and steel:						
Iron ore:						
Gross weight		11,965	9,285	6,625	6,462 r/	5,774
Fe content e/		8,260	6,220 3/	4,440	4,400 r/	3,900
Metal e/						
Pig iron		15,000	15,000	15,000	15,000	15,000
Steel, crude		5,000	5,000	5,000	5,000	5,000
Lead:						
Concentrate:						
Gross weight		110,507	115,042	114,184	117,535 r/	110,906
Pb content		77,056	79,300	79,900	81,208 r/	76,747
Cupreous matte, Pb content e/		500	600	600	600	600
Metal:						
Smelter, primary only		66,202	65,000 e/	65,209	66,812	58,178
Refined:						
Primary		64,202	60,929	65,209	66,812	58,178
Secondary e/		3,000	3,000	3,000	3,000	3,000
Total		67,000	64,000	68,000 r/	70,000	61,000
Manganese ore, largely chemical-grade		30,806	28,332	29,150	25,830	13,757
Mercury e/		5	10	10	10	10
Silver:						
Ag content of concentrates and matte	kilograms	35,000	66,531	51,197	43,000	42,000
Ag content of mine and smelter bullion	do.	226,000	240,412	226,692	246,000	238,000
Total	do.	261,000	306,943	277,889	289,000	280,000
Strontium		NA	NA	--	3,700 e/	3,700 e/
Zinc concentrate:						
Gross weight		171,796	216,011	216,197	201,692 r/	174,831
Zn content		89,248	112,000	111,703	103,064 r/	89,339

See footnotes at end of table.

Digitized by Google

TABLE 1--Continued
MOROCCO AND WESTERN SAHARA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1997	1998	1999	2000	2001
INDUSTRIAL MINERALS						
Barite		338,096	353,438	328,945	343,557 r/	471,102
Cement, hydraulic	thousand tons	7,236	7,414 r/	7,530 r/	8,100 r/	10,000 e/
Clays, crude:						
Bentonite		49,633	33,311	36,528	43,152 r/	71,741
Fuller's earth (smectite)		24,425	27,650	21,956	30,665	40,664
Montmorillonite (ghassoul)		2,933	3,180	2,750	2,476	2,270
Feldspar		15,110	18,332	1,112	6,052 r/	8,979
Fertilizers	thousand tons	2,200 e/	2,132	2,111	2,100 e/	2,000 e/
Fluorspar, acid-grade		103,800	105,000	83,100	76,991 r/	96,500
Gypsum e/		450,000	450,000	450,000	450,000	450,000
Mica		600 e/	600 e/	210	1,897	--
Phosphate rock:						
Gross weight 4/	thousand tons	23,084	23,587	22,163	21,463 r/	21,983
P_2O_5 content	do.	7,848	7,850	7,500	7,200	7,400
Phosphoric acid	do.	2,600 e/	2,669	2,696	2,732 r/	2,819
Salt:						
Rock		210,000 e/	107,604	156,158	147,960	150,000 e/
Marine e/		47,500	40,000	40,000	40,000	40,000
Talc and pyrophyllite		19,850	12,000 e/	14,655 r/	12,522 r/	15,000 e/
MINERAL FUELS AND RELATED MATERIALS						
Coal, anthracite		376,300	269,100	129,200	30,810 r/	1,908
Gas, natural:						
Gross	million cubic meters	38	43	44	44 e/	44 e/
Dry e/	do.	35	38	39	39	39
Petroleum:						
Crude	thousand 42-gallon barrels	35	35	35	35 e/	35 e/
Refinery products: 5/						
Liquefied petroleum gas	do.	2,500	2,600	3,100	2,800	2,800 e/
Gasoline	do.	3,400	3,600	3,800	3,800	3,800 e/
Jet fuel	do.	2,000	2,500	2,200	2,200	2,200 e/
Kerosene	do.	500	600	800	800	800 e/
Distillate fuel oil	do.	17,800	16,700	18,700	18,000 e/	18,000 e/
Residual fuel oil	do.	11,400	12,800	16,700	16,000 e/	16,000 e/
Other	do.	6,000	8,500	5,300	5,000 e/	5,000 e/
Total	do.	43,600	47,300	50,600	48,700 e/	48,600 e/

e/ Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. r/ Revised. -- Zero.

1/ Includes data available through October 2, 2002.

2/ In addition to the commodities listed, arsenic trioxide and a variety of crude construction materials are produced; but information is inadequate to make estimates of output levels.

3/ Reported figure.

4/ Includes estimated production of 1.5 million metric tons from Western Sahara.

5/ Refinery fuel and losses have been included in the output of individual products and is estimated to be about 1.8 million barrels per year.

Digitized by Google

TABLE 2
MOROCCO AND WESTERN SAHARA: STRUCTURE OF THE MINERAL INDUSTRIES IN 2001

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Anthracite coal	Charbonnages du Maroc (CdM) [Bureau de Recherches et de Participations Minières (BRPM), 98.89%]	Jerada	650,000.
Barite	Compagnie Marocaine des Barytes (COMABAR) (BRPM, 22.5%; Norbar Minerals AS, 55%)	Zelmou	150,000.
Do.	do.	Safi	80,000.
Do.	Société Nord Africaine de Recherches et d'Exploitation des Mines d'Argana (SNAREMA)	Argana	30,000 chemical grade.
Do.	do.	do.	120,000.
Bentonite	Tolsa, SpA (Tolsa, 100%)	Iboughardain	20,000.
Do.	Société d'Exploitation des Mines du Rif (SEFERIF) (BRPM, 100%)	Ouizane- Bouhoua	15,000.
Do.	Compagnie Marocaine des Barytes (COMABAR) (BRPM, 22.5%; Norbar Minerals, 55%)	Azzouzet-Tidiennit	36,000.
Cement	Asment de Temara (Cimentos de Portugal, 57.4%)	Temara	830,000.
Do.	Lafarge Ciments (Société Nationale d'Investissment, 50%)	Casablanca	2,000,000.
Do.	do.	Meknes	850,000.
Do.	do.	Tamuda	800,000.
Do.	do.	Tangier	350,000.
Do.	Cimenterie de l'Oriental (CIOR) (Holderbank, 51%; private, 35%)	Oujda	1,000,000.
Do.	do.	Ras El Ma	1,200,000.
Do.	Ciments du Maroc (Italcementi of Italy, 55.5%)	Agadir	1,100,000.
Do.	do.	Marrakech	1,300,000.
Do.	do.	Safi	650,000.
Cobalt	Compagnie de Tifnout Tiranimine (CTT) [Omnium Nord Africain (ONA), 55.2%; Société Metallurgique d'Imiter (SMI), 20%]	Bou Azzer	150,000 ore, 50,000 concentrate.
Copper	Société Minière de Bou Gaffer (SOMIFER) (BRPM, 34.2%, SMI 36%; ONA, 7.6%)	Bleida	50,000 concentrate.
Do.	Société de Développement du Cuivre de l'Anti-Atlas (SODECAT) (BRPM, 100%)	Tiouit	4,500 Cu, Au, Ag concentrate.
Fluorspar	Société Anonyme d'Entreprises Minières (SAMINE) (ONA, 58%; SMI, 42%)	Meknes	120,000 concentrate.
Gold	Akka Gold Mining Company (ONA, 70%; BRPM, 30%)	Iourim	NA.
Iron ore million metric tons	Société d'Exploitation des Mines du Rif (SEFERIF) (BRPM, 100%)	Nador	12.
Lead	Compagnie Minière de Guemassa (CMG) (ONA, 74%; BRPM, 26%)	Hajar	150,000 Zn concentrate, 32,000 Pb concentrate.
Do.	Compagnie Minière de Touissit (CMT) (50% Compagnie Royale Asturienne des Mines S.A., Belgium, 50%)	Touissit	73,000 concentrate.
Do.	Société de Développement Industrien et Minière (BRPM, 50%)	Zeida	40,000 concentrate.
Manganese	Société Anonyme Chérifienne d 'Etudes Minières (SACEM) [BRPM, 43%; Compagnie Minière de l'Ogooué SA, (COMILOG), 30%]	Quarzazate	130,000 concentrate.
Petroleum refinery products thousand 42 gallon barrels	Société Marocaine de l'Industrie du Raffinage (Corral Morocco Saudi Co., 100%)	Mohammedia	47,000.
Do. do.	Société Chérifienne des Pétroles (SCP) (Corral Morocco Saudi Co., 100%)	Sidi Kacem	9,500.
Phosphate million metric tons	Office Chérifien des Phosphates (OCP) (Government, 100%)	Youssoufia	6 concentrate.
Do.	do.	Benguerir	6 concentrate.
Do.	do.	Khouribga	4 concentrate.
Do.	do.	Sidi Chenan	5 concentrate.
Do.	do.	Bou Craa	6 concentrate.
Salt, rock	Société de Sel de Mohammedia (SSM) (BRPM, 100%)	Mohammedia	150,000.
Salt, marine	Société Chérifienne des Sels (SCS) [BRPM, 50%; Société Nouvelle des Salins du Sine Saloum (SNSSS), 50%]	Zima	50,000.
Silver kilograms	Société Metallurgique d'Imiter (SMI) (ONA, 67%; private, 20%; BRPM, 13%)	Near Quarzazate	210,000.
Steel rebar, wire rod	Société Nationale de Sidérurgie (SONASID) (private, 65%)	Nador	480,000.
Zinc	Omnium Nord Africain mine and plant (ONA, 100%)	Guemassa	265,000 concentrate.
Zircon	Agrupacion Minera de Investigaciones SA	Guelmin	NA.

NA Not available.

Digitized by Google

Digitized by Google

THE MINERAL INDUSTRY OF

MOZAMBIQUE

By Thomas R. Yager

In recent years, the mineral industry of Mozambique has produced aluminum and gold and such industrial minerals as bauxite, bentonite and other clays, gemstones, graphite, and salt. The country has also produced coal, natural gas, and such building materials as cement, gravel, marble, and sand. Deposits of asbestos, copper, diatomite, feldspar, fluorspar, gypsum, iron ore, limestone, manganese, mica, nepheline syenite, perlite, phosphate rock, rare earths, silica sand, tantalum, and titanium are also known to occur in Mozambique.

The International Monetary Fund (2002b, p. 174) estimated that Mozambique's gross domestic product (GDP) grew by 13.9% in 2001 compared with 1.6% in 2000, 7.5% in 1999, and 12.6% in 1998. Construction accounted for 11.7% of the GDP; manufacturing, 10.7%; electricity and water, 2.1%; and mining, 0.3%. The GDP at purchasing power parity amounted to $17.8 billion in 2001, and the per capita GDP at purchasing power parity was about $1,000. The GDP at market exchange rates was nearly $3.6 billion (International Monetary Fund, 2002a, p. 6; 2002a§[1]-c§).

The value of output in the mining sector increased by 11.8% in 2001 after decreasing by 29.4% in 2000 and 6.3% in 1999. The contraction of the mining sector in 1999 and 2000 was partially attributable to the closure of the Ancuabe graphite mine and severe flooding. In 2001, the construction sector grew by 53.6% after growing by 1.5% in 2000, 3.5% in 1999, and 26.1% in 1998. The rapid growth of the construction sector in 2001 was partially attributable to the recovery from the floods in 2000 (International Monetary Fund, 2002a, p. 7; Mozambique News Agency, 2002§).

Commodity Review

Metals

Aluminum.—The Mozal aluminum smelter, which used alumina imported from western Australia as raw material, increased output to 266,000 metric tons (t) in 2001 from 53,800 t in 2000 (table 1). Mozal was jointly owned by BHP Billiton plc (47.11%), Mitsubishi Corporation (25%), Industrial Development Corporation of South Africa Ltd. (IDC) (24.04%), and the Government of Mozambique (3.85%).

The smelter has had substantial effects on the economy of Mozambique. In 2001, exports of aluminum ingots produced at Mozal amounted to $383.5 million; this was about 54% of total export earnings. Without Mozal, total exports would have increased by only 5.4% instead of 93.3% in 2001. A new port, a new road, and a bridge were constructed at Matola to handle Mozal's exports. The construction of the first phase of Mozal consumed about 25,000 t of steel and 235,000 cubic meters of concrete. Work on the second phase of Mozal (the Mozal 2 project) contributed to the high rate of growth in the construction sector in 2001 (Engineering & Mining Journal, 2001; Mozambique News Agency, 2002§).

The Mozal 2 project was expected to double Mozal's rated capacity to 506,000 metric tons per year (t/yr) by late 2003. International loans accounted for $600 million of the financing for this project, including $250 million from South Africa and $150 million from France. Billiton provided the remaining $400 million (Africa Mining Intelligence, 2001a).

A small bauxite mine in Manica Province was operated by E.C. Meikles (Pty.) Ltd., Zimbabwe. In 2001, output increased to 8,600 t from 8,130 t in 2000 (table 1). All Mozambique's bauxite production was exported in 1999 and 2000 (Afonso Mabica, Mozambique National Directorate of Mines, written commun., 2001).

Gold.—Mozambique's gold resources were located in lode and placer deposits throughout the country. Gold was produced in Manica, Nampula, Niassa, and Tete Provinces by artisanal miners. Officially reported production of gold increased to 23 kilograms (kg) in 2000 from 6 kg in 1997 (table 1). Exports of gold amounted to 8 kg in 1999 and 17.4 kg in 2000. From 1997 to 2000, about 60% of officially reported gold production originated in Manica. Most of Mozambique's gold production was not included in official figures; actual output was estimated to range from about 360 to 480 kilograms per year (Dreschler, 2001, p. 46, 48; Afonso Mabica, Mozambique National Directorate of Mines, written commun., 2001).

In Manica and parts of Niassa, mercury was used intensively to recover fine particles of gold; this caused air and water pollution. Other environmental problems associated with artisanal gold mining included soil erosion and water siltation. The Government has been attempting to train miners to use less environmentally harmful methods of gold recovery (Dreschler, 2001, p. 42, 44, 54).

In 2000, Twigg Minerals plc carried out geochemical soil sampling in the Namama Belt near Majele. In March 2001, the Government awarded Twigg a prospecting license for the Majele area. The company already held several reconnaissance licenses in the Namama Belt. In June, Twigg announced its intention to raise additional working capital to fund further gold exploration in Mozambique (Resource Information Unit, 2001).

Kenmare Resources plc held two exploration licenses in the Niassa Province. In 1998, the company deferred work on these licenses owing to low gold prices and logistical difficulties. Kenmare searched for a joint-venture partner, but in September

[1]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

2001, the company announced its intention to dedicate all remaining resources to the Moma Titanium Minerals Project (Africa Mining Intelligence, 2001b; Resource Information Unit, 2001).

Iron and Steel.—The Maputo Iron and Steel Project (MISP) was a joint venture between Enron Corp. and a consortium of five steel and engineering companies to build a steel plant in Maputo. Enron held a 50% stake in the project, and the remaining 50% was shared by Duferco SA of Switzerland, Kobe Steel Ltd., Midrex Technologies, Inc., Tecnica Internazionale SpA of Italy, and Voest-Alpine Industrieanlagenbau GmbH & Co. of Austria. The MISP was expected to produce 2 million metric tons per year of semimanufactured steel slabs from imported iron ore. Construction was expected to start at the beginning of 2002 and be completed in early 2005 (Metal Bulletin, 2001a).

In May, Enron signed an implementation agreement with the Government for the MISP. The consortium, however, disbanded, and Enron suspended development on the MISP in November. Enron filed for bankruptcy in December, and no other company expressed an interest in the project (Metal Bulletin, 2001a, 2002).

In 2001, India's Tata Iron & Steel Company Ltd. discussed the possibility of setting up a project for high-carbon ferrochrome in Mozambique. The cost of the project was estimated to be $64 million (Metal Bulletin, 2001c).

Tantalum.—Hegemony Resources operated the Naquissupa open pit tantalite mine, which was located in the Gilé District of Zambezia Province. The Naquissupa Mine employed 195 workers and had a capacity of 120 metric tons per hour of ore. The mine was expected to have a life of 15 years. In 2001, the Government announced that the Marropino, the Morrua, and the Muiane tantalite mines would be reopened by 2003. These mines were in pegmatites in the Alto Ligonha district (Moçambique on-line, 2001§).

Twigg Minerals plc explored for tantalum on its properties in the Namama Belt and was seeking a joint-venture partner. Alvorada de Mozambique Lda also explored for tantalum. In 2001, Longreach Gold Oil Ltd. reached a conditional option agreement with a company that held tantalum mining and exploration licenses. Longreach would be able to acquire a 25% interest in the tantalum projects (Minerals Gazette, 2001; Resource Information Unit, 2001).

Titanium and Zirconium.—The Corridor Sands project was based upon 10 deposits of heavy-mineral sands near Chibuto in southern Mozambique. Western Mining Corp. (WMC) of Australia held a 60% interest in the project, and Southern Mining Corp. of Johannesburg, 40%. WMC indicated that its feasibility study on Corridor Sands was likely to be completed in the first half of 2002. If the results of the study were favorable, then production would start in the first half of 2005. WMC hoped to produce 375,000 t/yr of titanium slag, 195,000 t/yr of iron, 30,000 t/yr of zircon, and 12,000 t/yr of rutile from 2005 through 2008. By 2017, the company planned to produce 1 million metric tons per year (Mt/yr) of titanium slag, 520,000 t/yr of iron, 110,000 t/yr of zircon, and 32,500 t/yr of rutile (Smith, 2002, p. 16, 25, 27).

Kenmare Resources plc held a mining license for the Moma mineral sands. According to the company's feasibility study completed in 2001, the Moma project was likely to require an investment of $160 million and to produce a cash flow of more than $50 million per year. Kenmare planned to start production in 2004 and to produce 625,000 t/yr of ilmenite, 24,000 t/yr of zircon, and 12,500 t/yr of rutile. Resources at Moma were capable of sustaining the project at this rate of production for at least 20 years. Kenmare was negotiating with potential customers and planned to seek funding from institutions and commercial banks (Mining Journal, 2001; Kenmare Resources plc, 2002, p. 5-6).

Industrial Minerals

Bentonite and Other Clays.—Bentonite was mined at Boane in southern Mozambique by Cia Desenvolvimento Mineira, which was operated by a group of local investors. Production of crude bentonite increased to 16,144 t in 2000 from 12,625 t in 1997 (table 1). Exports of processed bentonite amounted to 480 t in 1999 and 172 t in 2000 (Afonso Mabica, Mozambique National Directorate of Mines, written commun., 2001). Mozambique also had deposits of kaolin and other clays.

Cement.—Cimentos de Portugal, SGPS, SA held a 51% stake in Cimentos de Mocambique SARL, which was the country's only cement producer. The Dondo, Matola, and Nacala plants had a combined clinker grinding capacity of 585,000 t/yr. In 2001, Cimentos de Portugal started the construction of a new clinker grinding facility at the Matola plant. Other planned upgrades at Matola included the overhaul of the crushing plant, the remodeling of the cement silos, and the construction of new bagging facilities and hangers to store clay and limestone. The capacity expansions at Matola were expected to increase domestic cement capacity to nearly 900,000 t/yr (International Cement Review, 1998; Cimentos de Portugal, SGPS, SA, 2002, p. 3, 61).

Mozambique's consumption of cement was estimated to have increased to 504,000 t in 2001 from 415,000 t in 2000, 360,000 t in 1999, and 313,000 t in 1998. Cimentos de Portugal's share of the domestic market was 84%. Nearly one-half of domestic cement demand was met through imports (Cimentos de Portugal, SGPS, SA, 2001, p. 78; 2002, p. 62).

Diamond.—The Portugese company TAMEGA held a diamond prospecting license in Niassa Province. TAMEGA also indicated an interest in exploring for diamonds along the Limpopo and Pafuri Rivers (Mining Annual Review, 2001).

Gemstones.—Alvorada de Mozambique Lda held mining licenses for the Maria III and Maria Norte Mines, which produced aquamarine, emerald, garnet, and tourmaline. Operations started at the Maria III Mine in October 2000 and continued through at least December 2000. Other gemstone production in recent years included amethyst, emerald, and rose quartz from Alto Ligonha; aquamarine from Macula, Mocuba,

Digitized by Google

Monapo, and Muiane; garnet from Cuamba; and tourmaline from Muiane, Nacala, and Naipa (Alvorada de Mozambique Lda, undated a, b; Shigley and others, 2000, p. 311, 318, 320-322).

Most of Mozambique's gemstones were produced by artisanal miners and were sold to unlicensed traders. The gemstone trade was dominated by dealers from South Africa and some West African countries; other dealers came from Germany, Taiwan, and the United States (Dreschler, 2001, p. 47).

Graphite.—The Ancuabe graphite mine in Cabo Delgado Province was placed on care and maintenance by Kenmare in October 1999. Kenmare had been attempting to secure the working capital needed to reopen the mine, but in September 2001, the company announced plans to dedicate all its remaining resources to developing the Moma Titanium Minerals Project (Africa Mining Intelligence, 2001b).

Salt.—Producers of salt in Mozambique included Afrisal do Mar SARL, Industria Salineira de Hiozazane, Salina Fragoso, Salina Raio Solar, and Salina Zacarias. Mozambique exported salt to Lesotho, Malawi, Swaziland, and Zimbabwe. In 2000 and 2001, damage to equipment and the loss of evaporation ponds from flooding caused the salt industry to shut down. The United Nations Industrial Development Organization and the Government aided salt producers with the rehabilitation of equipment and the long-run development of the industry.

Mineral Fuels

Coal.—Mozambique had substantial deposits of coal, which include Maniamba, Minjova, Moatize, and Mucanha-Vuzi. Small amounts of coal were mined from Moatize by Carbomoc, which was a state-owned company, and exported to Malawi. Exports of coal amounted to 20,502 t in 1999 and 29,010 t in 2000 (Afonso Mabica, Mozambique National Directorate of Mines, written commun., 2001).

The Government planned to raise nearly $1 billion to rehabilitate the Moatize coal mines, to repair the Sena railway line, and to build facilities in the Port of Beria. The Brazilian iron ore producer Companhia Vale do Rio Doce was approached by the Government for a loan (Africa Mining Intelligence, 2001c).

Natural Gas.—The Pande gasfield was exploited on a small-scale basis for domestic consumption. In 2001, Sasol Ltd. signed deals with the Government regarding construction and ownership of a $1.2 billion pipeline to transport gas from Mozambique to South Africa. The project would also develop the Pande and Temane gasfields. Sasol would hold a 50% stake in the project, and the Governments of Mozambique and South Africa would each hold 25%.

Production of gas would reach a rate of 5.7 million cubic meters per day in 2004; the Temane field would be the first field to go into large-scale production. Revenues from the project were expected to be about $400 million per year. Roughly 10% of the gas produced from the Pande and Temane fields was expected to be consumed domestically (Africa Energy & Mining, 2000a). The collapse of Enron and the Maputo Iron and Steel Project forced Sasol to seek alternative customers.

Petroleum.—Mozambique produced neither crude petroleum nor refined petroleum products and relied on imports, which were sourced mainly from South Africa. The country consumed an estimated 3.29 million barrels of petroleum products in 2000.

Infrastructure

Mozambique had installed electrical generating capacity of 2,313 megawatts (MW); the Cabora Bassa dam accounted for 2,075 MW. Another dam was to be built on the Zambezi River at Mepanda Uncua with a capacity range from 1,200 to 2,400 MW. Mozambique's exploitable potential hydroelectric energy has been estimated to be 14,000 MW. In 2001, exports of electricity fell to $57.3 million from $67 million in 2000 and $62.9 million in 1999. Exports of electricity amounted to 8% of Mozambique's total exports (Africa Energy & Mining, 2000b; International Monetary Fund, 2002a, p. 35).

MOTRACO (a consortium formed by Electricidade de Mozambique, Eskom of South Africa, and the Swaziland Electricity Board) provided the power for the Mozal smelter. South Africa had been the source of power for Mozal; Mozambique would provide most of the electricity in the future. Mozal was expected to consume 900 MW of capacity after its expansion in 2003. The smelter's demand for power was expected to accelerate the development of new hydropower projects in Mozambique, which included the dam at Mepanda Uncua (Mozambique News Agency, 2001§).

Mozambique had about 30,400 kilometers (km) of roads, of which approximately 5,700 km was paved. The rail network covered about 3,100 km. The country had 306 km of crude petroleum pipelines and 289 km of petroleum products pipelines; the pipeline from Beira to Harare carried petroleum products to Zimbabwe. Ports and harbors were Beira, Inhambane, Maputo, Nacala, Pemba, and Quelimane; navigable waterways covered about 3,750 km.

Outlook

The International Monetary Fund (2002b, p. 174) predicted that Mozambique's GDP would increase by 9% in 2002 and 5.6% in 2003. The mining sector was expected to grow by 15% per year from 2002 to 2005. In 2002, rapid growth was likely to continue in the construction sector; most of this increase would be attributable to the Mozal 2 project. By 2003, Mozal's cash costs were expected to be among the lowest in the world owing to low electricity costs and economies of scale. Global primary aluminum consumption was expected to fall by about 0.8% in 2002 and to increase by 4.9% in 2003. Worldwide primary aluminum smelter capacity was expected to increase by 1.9% per year in 2002 and 2003. Consumption of cement was expected to reach 1 Mt/yr by 2005, and demand for other building materials, such as clays, gravel and crushed rock, limestone, and marble, would be likely to increase as well. Coal production could increase significantly if the rail link between

Digitized by Google

the Moatize Mine and the port of Beira were restored (International Cement Review, 2001; International Monetary Fund, 2001, p. 34; Metal Bulletin, 2001b; SG Securities, 2001, p. 5).

The outlook for gold and titanium minerals depends heavily upon global market trends. Modest decreases in gold mine production by 2003 are likely to be offset by falling demand. Demand for titanium dioxide pigment is expected to increase by about 3% to 4% per year from 2002 to 2006 (Gambogi, 2001; SG Securities Ltd., 2001, p. 22).

References Cited

Africa Energy & Mining, 2000a, Mozambique—Gas pipeline contract: Africa Energy & Mining, no. 285, October 25, p. 4.

Africa Energy & Mining, 2000b, Mozambique—The energy potential: Africa Energy & Mining, no. 274, May 3, p. 4.

Africa Mining Intelligence, 2001a, Mozambique—Additional funding for Mozal: Africa Mining Intelligence, no. 18, July 11, p. 3.

Africa Mining Intelligence, 2001b, Mozambique—Kenmare risks its all: Africa Mining Intelligence, no. 21, September 12, p. 3.

Africa Mining Intelligence, 2001c, Mozambique—Seeking $1 billion for coal project, Africa Mining Intelligence, no. 19, July 25, p. 3.

Cimentos de Portugal, SGPS, SA, 2001, Annual report 2000: Lisbon, Portugal, Cimentos de Portugal, SGPS, SA, 214 p.

Cimentos de Portugal, SGPS, SA, 2002, Annual report 2001: Lisbon, Portugal, Cimentos de Portugal, SGPS, SA, 157 p.

Dreschler, Bernd, 2001, Small-scale mining and sustainable development within the SADC region: London, United Kingdom, International Institute for Environment and Development, 165 p.

Engineering & Mining Journal, 2001, Mozal smelter named "project of the year": Engineering & Mining Journal, v. 202, no. 12, December, p. 16BB-16DD.

Gambogi, Joseph, 2001, Titanium: Engineering & Mining Journal, v. 202, no. 4, April, p. 50-52.

International Cement Review, 1998, Mozambique, *in* Global cement report: Dorking, United Kingdom, Tradeship Publications, Ltd., p. 203.

International Cement Review, 2001, Mozambique, *in* Global cement report: Dorking, United Kingdom, Tradeship Publications, Ltd., p. 214.

International Monetary Fund, 2001, Mozambique—2000 article IV consultation and second review under the poverty reduction and growth facility—Staff report, staff statement, public information notice and press release on the executive board discussion, and statement by the authorities of Mozambique: Washington, DC, International Monetary Fund, January 17, 80 p.

International Monetary Fund, 2002a, Republic of Mozambique—Statistical appendix: Washington, DC, International Monetary Fund, July 9, 38 p.

International Monetary Fund, 2002b, World economic outlook—Trade and finance: Washington, DC, International Monetary Fund, September 25, 235 p.

Kenmare Resources Plc, 2002, Annual report—2001: Dublin, Ireland, Kenmare Resources Plc, 36 p.

Metal Bulletin, 2001a, Enron clinches Mozambique deal: Metal Bulletin, no. 8580, June 4, p. 20.

Metal Bulletin, 2001b, Rise in Al production costs unlikely to continue—AME: Metal Bulletin, no. 8558, March 15, p. 5.

Metal Bulletin, 2001c, Tisco ponders Mozambique for ferro-chrome project: Metal Bulletin, no. 8601, August 20, p. 8.

Metal Bulletin, 2002, Maputo slab project dies with Enron: Metal Bulletin, no. 8645, January 31, p. 20.

Minerals Gazette, 2001, Longreach enters Mozambique: Minerals Gazette, v. 2, no. 43, May, p. 28.

Mining Annual Review, 2001, Mozambique, *in* Mining annual review 2001: London, United Kingdom, Mining Journal Ltd. CD-ROM.

Mining Journal, 2001, Moma encouragement: Mining Journal, v. 336, no. 8623, March 2, p. 155-157.

Resource Information Unit, 2001, Mozambique, *in* Register of African mining 2001/02: Subiaco, Australia, Resource Information Unit, p. 181-183.

SG Securities Ltd., 2001, Quarterly metals review—A mountain to climb: London, United Kingdom, SG Securities Ltd., October, 28 p.

Shigley, J.E., Dirlam, D.M., Laurs, B.M., Boehm, E.W., Bosshart, George, and Larson, W.F., 2000, Gem localities of the 1990s: Gems & Gemology, v. 36, no. 4, winter, p. 292-335.

Smith, Ian, 2002, Corridor Sands titanium feedstock: Melbourne, Australia, Western Mining Corp., 29 p.

Internet References Cited

Alvorada de Mozambique Lda, [undated]a, Collections samples, accessed January 8, 2003, at URL http://www.mining.8m.com/custom4.html.

Alvorada de Mozambique Lda, [undated]b, Mine Maria III, accessed January 8, 2003, at URL http://www.mining.8m.com/photo2.html.

International Monetary Fund, 2002a (April), Gross domestic product at current prices—All countries, World Economic Outlook Database, accessed August 14, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/01/data/ngdpd_a.csv.

International Monetary Fund, 2002b (April), Selected world aggregates, World Economic Outlook Database, accessed June 10, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/01/data.

International Monetary Fund, 2002c (April), Shares of aggregate GDP based on purchasing power parity (PPP) valuation of country GDP—Developing countries, World Economic Outlook Database, accessed June 10, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/01/data.

Moçambique on-line, 2001 (November 29), No Gilé—Chissano inaugura mina de tantalite, accessed November 21, 2002, at URL http://www.mol.co.mz/noticias/011129.html.

Mozambique News Agency, 2001 (June 29), AIM reports—Phase two of Mozal given go-ahead, accessed October 15, 2002, at URL http://www.poptel.org.uk/mozambique-news/newsletter/aim210.html.

Mozambique News Agency, 2002 (April 11), AIM reports—Mozambique keeps up rapid economic growth, accessed November 11, 2002, at URL http://www.poptel.org.uk/mozambique-news/newsletter/aim229.html.

Digitized by Google

TABLE 1
MOZAMBIQUE: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1997	1998	1999	2000	2001 e/
Aluminum:						
Bauxite		8,218	6,130	7,883	8,130	8,600 3/
Metal, refined		--	--	--	53,800	266,000 3/
Cement, hydraulic	thousand tons	220	212 r/	216 r/	270 r/	265 3/
Clays, bentonite:						
Crude		12,625	10,448	10,828	16,144	17,700
Processed		NA	NA	360	274	300
Coal, bituminous		-- r/	-- r/	8,573	16,115	17,700
Gemstones, semiprecious:						
Cut stones, all types	carats	5,168	5,303	5,000 r/ e/	3,500 r/ e/	3,900
Rough stones	kilograms	1,091	1,465	1,400 r/ e/	1,000 e/	1,100
Gold 4/	do.	6	17	19	23	25
Graphite, concentrates		5,125	5,889	4,007	--	--
Gravel and crushed rock	cubic meters	123,532	282,832	265,000 r/ e/	187,000 r/ e/	209,000
Marble:						
Block	do.	251	117	110 r/ e/	75 r/ e/	85
Slab	square meters	13,820	2,736	2,600 r/ e/	1,800 r/ e/	2,000
Natural gas	million cubic meters	--	60 3/	60 r/ 3/	60 r/ e/	60
Salt, marine e/		73,000 r/	88,000 r/	82,000 r/	7,000 r/	10,000

e/ Estimated; estimated data are rounded to no more than three significant digits. r/ Revised. NA Not available. -- Zero.

1/ Data available through September 5, 2002.

2/ In addition to the commodities listed, construction materials (other clays, sand and gravel, and stone) and tantalum were produced. However, output is not reported quantitatively, and information was insufficient to make reliable estimates.

3/ Reported figure.

4/ Does not include unreported production; total output of gold was estimated to be roughly 360 to 480 kilograms per year.

TABLE 2
MOZAMBIQUE: STRUCTURE OF THE MINERALS INDUSTRY IN 2001

(Metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Aluminum	Mozal SARL (BHP Billiton plc, 47%; Mitsubishi Corporation, 25%; Industrial Development Corporation, 25%; Government, 4%)	Maputo	253,000
Bauxite	E.C. Meikles (Pty.) Ltd.	Monte Snuta	8,500
Bentonite 1/	Cia Desenvovimento Mineiro	Boane	NA
Cement	Cimentos de Mocambique, SARL (Cimentos de Portugal, SGPS, SA, 51%)	Dondo, Matola, and Nacala	585,000
Coal, bituminous	Carbomoc	Moatize	60,000
Graphite 2/	Kenmare Resources plc	Ancuabe	10,000
Marble, block cubic meters	Marmonte E.E.	Montepuez	1,500

NA Not available.

1/ Capacity of crude bentonite was estimated to be at least 18,000 metric tons per year based on recent production data.

2/ Production ceased in 1999; on care and maintenance in 2001.

Digitized by Google

Digitized by Google

THE MINERAL INDUSTRY OF

NAMIBIA

By George J. Coakley

Namibia is located on the southwestern coast of Africa between South Africa and Angola. In 2001, the 825,418-square-kilometer country had an estimated population of 1.8 million and a gross domestic product (GDP) per capita of about $4,500[1] based on purchasing power parity. In 2001, the mineral industry of Namibia provided about 69% of exports and 20% of the country's GDP. Namibia had a negative merchandise trade balance of $185 million in 2001. Total exports were valued at $1,047.7 million, of which diamonds accounted for $530.4 million; gold, $24.4 million; zinc,$15.8 million; and other minerals, primarily uranium, $155 million. Total merchandise imports were valued at $1,232.8 million, of which fuel and energy products accounted for $95 million. Diamond remained the most important sector of the mining industry followed by uranium, for which Namibia ranked as the world's fourth largest producer. Namibia was also the second largest producer of salt in Africa. Other important mineral products included copper, dimension stone (granite and marble), fluorite, gold, lead, silver, and zinc (Bank of Namibia, 2002§[2]; Central Intelligence Agency, 2002§).

Commodity Review

Metals

Copper.—Ongopolo Mining and Processing Limited [a partnership between former managers of Tsumeb Copper Limited (TCL) and the National Union of Namibian Workers (NUMW)] continued operations of the Tsumeb copper smelter and the Khusib Springs, Kombat, and Otjihase copper-lead-silver mines during 2001. Ongopolo ramped up to full production during its first full year of operations following the reopening of the old TCL properties in March 2000. Production of copper contained in concentrates increased 20% to 12,392 metric tons (t) in 2001 and that of blister copper by fivefold to 27,015 t, which included blister copper production from imported toll concentrates. In June 2001, Ongopolo signed a new wage and benefit agreement with NUMW that included a new bonus system as part of an overall agreement to reduce "a serious absenteeism rate" at the company (Ongopolo Mining & Processing Limited, 2001§). In January 2002, Ongopolo signed an agreement with ZincOx Resources Plc of the United Kingdom to evaluate the potential for exploiting the old 2.9-million-metric-ton (Mt) Tsumeb slag dumps that contain 9.03% zinc, 2.05% lead, from 183 to 263 parts per million (ppm) germanium, approximately 200 ppm gallium, and approximately 170 ppm indium. The companies would use the existing Ausmelt furnace at Tsumeb to reduce the slag to a zinc-rich oxide dust. ZincOx can earn a 50.1% interest in the project over the next 18 months by providing metallurgical expertise, completing a feasibility study, and making a payment of $2.2 million to Ongopolo. Ongopolo will earn its 49.9% interest in the new company by contributing the slag dumps, the Ausmelt furnace, and infrastructure development (Ongopolo Mining & Processing Limited, 2002a§; ZincOx Resources Plc, 2002§). Ongopolo reported remaining ore reserves at Khusib Springs to be 105 Mt at a grade of 3.58% copper; Kombat, 8.4 Mt at a grade of 2.49% copper; and Otjihase, 10.3 Mt at a grade of 1.82% copper. In the mineral-resource category, the company reported an additional 30 Mt of ore at Otjihase, 27 Mt of ore at Kombat, and 500,000 t of ore at Khusib Springs (Ongopolo Mining & Processing Limited, 2002b§).

Gold.—AngloGold (Namibia) Pty. Ltd. held a 100% interest in the Navachab gold mine near Karibib. Navachab had the capacity to treat 1.32 million metric tons per year (Mt/yr) of ore. The Navachab deposit occurs within the Damara Greenstone Belt and is hosted by green schist-amphibolite facies, marbles, and volcanoclastics. Gold mineralization is concentrated in a sheeted vein set and in a replacement skarn body. In 2001, production was 2,694 kilograms (kg) compared with 2,399 kg in 2000. The increase was attributed to a higher yield of gold of 2.04 g/t in 2001 from 1.82 g/t in 2000. As of yearend 2001, mineral reserves were reported to be 4.5 Mt at a grade of 1.65 g/t gold and mineral resources to be 81.6 Mt at a grade of 1.06 g/t gold. During 2001, AngloGold was reevaluating the potential of extending the mine life at current production levels from 2005 to 2013 (AngloGold Limited, 2002§).

Lead and Zinc.—Construction of Skorpion Zinc's $454 million zinc mine and refinery project progressed during 2001 with commissioning expected by yearend 2002; the copmany was 100% owned by Anglo American plc. The deposit is located approximately 85 kilometers (km) northeast of Oranjemund and 25 km north of Rosh Pinah. The open pit mine will be based on proved reserves of 11.8 Mt at a grade of 11.33% zinc and probable reserves of 9.8 Mt at a grade of 9.66% zinc (Anglo American plc, 2002). The unusual zinc silicate and carbonate mineralogy will be treated by a direct acid leach of the ore, solid liquid separation, a unique zinc solvent extraction and electrowinning to produce special high-grade zinc. Skorpion was expected to produce 150,000 metric tons per year (t/yr) of zinc during a mine life of at least 15 years.

[1]Where necessary, values have been converted from Namibian dollars (N$) to U.S. dollars (US$) at the rate of N$8.496=US$1.00 for 2001 and N$6.826=US$1.00 for 2000.

[2]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

Tantalum.—Reefton Mining N.L. of Australia held seven exploration licenses in what they referred to as the Sandamap-Erongo base-metals, gold, and tantalite project in northwestern Namibia. The concessions included several pegmatite zones previously mined for tantalite, tin, and tungsten. Reefton conducted soil sampling and 60 reverse circulation exploration drill holes in several tantalum-bearing pegmatites during 2001 and was seeking a joint-venture partner to continue work in the area (Reefton Mining N.L., 2002§).

Uranium.—Rössing Uranium Ltd., which was owned by Rio Tinto plc of the United Kingdom (68.6%), was the fifth largest producing uranium mine in the world by contributing 2,643 t of uranium oxide, or 6.3% of world supply in 2001 (Uranium Information Center, 2002§). Production declined by 17% in 2001 compared with that of 2000 as ore processed dropped to 9.08 Mt from 11.04 Mt. At one of the largest open pit mines in the world, which moves more than 25 Mt/yr of ore and waste material, Rössing reported reserves in 2002 sufficient to maintain the mine life for an additional 16 years. The company completed its N$267 million ($31.4 million in 2000 U.S. dollars) 5-year investment to reduce cost and increase productivity, with annual of N$150 million ($17.6 million) realized in 2001. Cash incentive bonuses ($2 million in 2001) for its 790 employees were built into the cost reduction program. Following a market study, Rössing mothballed its sulfuric acid plant in 2000 and began using cheaper acid imported through Walvis Bay (Rössing Uranium Ltd., 2002§).

Industrial Minerals

Diamond.—Exploration and development of new diamond fields, particularly offshore, remained active in 2001 and demonstrated the potential to expand this $500 million sector of the Namibian mineral economy. Diamond accounted for nearly 51% of total exports in 2001, although production of diamond decreased by 4% to 1.49 million carats; slightly more than one-half came from marine sources. Namdeb Diamond Corp. (Pty.) Ltd. (Namdeb), which was established in 1994 as a 50-50 joint venture between De Beers Centenary AG and the Namibian Government, was the largest diamond producer. During 2001, Namdeb produced 1,384,704 carats, of which 39% came from offshore marine mining. Production in 2001 came from four onshore and one marine operations. Mining area 1, which was nearing the end of its economic life, treated 17.8 Mt of materials that yielded 618,108 carats; the Orange River mines at Daberas treated 2.7 Mt of materials that yielded 30,731 carats; the Elizabeth Bay Mine treated 1.97 Mt of materials that yielded 93,891 carats; beach and marine contractors, many of whom were Namibian empowerment groups, recovered 99,057 carats; and marine mining operations conducted by De Beers Marine Namibia (Debmarine) in the Atlantic 1 license area recovered 537,389 carats. Debmarine, which was controlled by De Beers (70%) and Namdeb (30%) maintained a fleet of four mining vessels and two prospecting vessels. As of yearend 2000, Namdeb reported remaining resources and reserves (land plus marine) as follows: probable reserves at 59.4 Mt at a grade of 1.5 carats per 100 t, indicated total resources of 73.6 Mt at a grade of 2.3 carats per 100 t, and inferred total resources of 301.7 Mt at a grade of 1.5 carats per 100 t. During 2001, Namgen Diamond Manufacturing Co. (Pty.) Ltd. (a subsidiary of Namdeb) produced approximately 30,000 polished stones that were valued at $5.59 million at its cutting and polishing plant at Okahandja, which is located about 70 km north of Windhoek; 95% was exported (Namdeb Diamond Corp. (Pty.) Ltd., 2002, undated§).

Namibian Minerals Corp. (Namco), which was a United Kingdom-based firm listed on the Namibian and Toronto, Ontario, Canada, stock exchanges, mined diamonds from its offshore Koichab prospect in Luderitz Bay. It owned three former Ocean Diamond Mining airlift mining vessels—the *Ivan Prinsep*, *MV Namibian Gem,* and *Oceandia*—and two Namco mining vessels—*MV Kovambo* and *MV Ya Toivo*—supporting the Namco-developed underwater NamSSol I and NamSSol II (Nam 2) seabed mine-crawlers with a combined capacity of around 400,000 carats per year. Namco, which was the second largest diamond producer after Namdeb, struggled to continue operations during 2001 after its NamSSol I mining tool was damaged in an underwater landslide in January 2001 and *MV Kovambo* was placed on care and maintenance. The resulting loss of cash flow led to an overall loss of $56 million for the year and defaults on its obligations to lenders. Several of Namco's Southern African subsidiaries were placed in provisional liquidation in February 2001. Despite efforts at debt rescheduling and a capital infusion by LL Mining Corp. (a member of the Leviev Group of Israel) the company struggled to keep its mining fleet operating for only portions of the year. LL Mining invested $15 million in return for exclusive marketing rights to Namco diamond production. Production for 2001 declined to 85,589 carats at an average sales value of $140 per carat compared with 221,000 carats at an average sales value of $176 per carat in 2000 (Namibian Minerals Corp., 2002§).

The third and only other major diamond producer Diamond Fields International Ltd. (DFI) of Canada received a 15-year mining license from the Government in February 2001 and began mining operations at its Marshall Fork and Diaz 12 marine deposits with its joint-venture partner the Trans Hex Group Ltd. in May. DFI contributed the mining license, and Trans Hex two air-lift mining vessels to the joint venture (Diamond Fields International Ltd., 2001§). For the financial year ending June 30, 2002, the joint venture mined 35,967 carats of diamond, which included one 17.42 carat stone. Sales of 35,436 carats earned $2.9 million for an average of $82 per carat. On the basis of DFI quarterly reports, production from the Marshall Fork area for calendar year 2001 beginning with startup on May 24 was 16,470 carats. In July 2002, Trans Hex's withdrawal of its support and mining vessels from the joint venture triggered a $19 million litigation by DFI, which committed to operating the license areas alone and planned on buying, equipping, and commissioning one mining vessel by August 2003 and another in 2004 (Diamond Fields International Ltd. 2002§).

Other companies active in diamond exploration during 2000 included the Australian companies Mount Burgess Gold Mining Co. NL and Kimberlite Resources Pty. Ltd. that continued geophysical and heavy-mineral concentrate sampling exploration for diamond-bearing source-rock kimberlites in the

Digitized by Google

Tsumkwe region in northeastern Namibia near the Botswana border. In December 2001, Mount Burgess announced the discovery of the Gura 1 kimberlite and that it will continue exploration in the area during 2002 (Mount Burgess Gold Mining Co. NL, 2002§). Reefton also held three exploration licenses for diamond that covered 200 km of coastline beaches along the Skeleton Coast. During 2001, Afri-Can Marine Minerals Corp. of Canada continued geophysical exploration and initial sampling on 28 concessions that measured 26,500 square kilometers off the coast of Namibia in two main areas—the Northern Blocks, which are northwest of Hottentot Bay, and Southern Concessions (Namibian Gemstones Block), whichi is southwest of Elizabeth Bay (Afri-Can Marine Minerals Corp., 2002§).

Fluorspar.—Okorusu Fluorspar (Pty.) Ltd. was operated as a captive mine to supply fluorspar to its parent company Solvay AG of Germany. Following completion of its major expansion project in 2000, production during 2001 increased by 23% to 81,245 t of fluorspar. The company continued exploration to define the resources at its Okurusu Mine and was negotiating to obtain exploration and development rights to the nearby Omburu fluorspar prospect (Chamber of Mines of Namibia, 2002).

Mineral Fuels

Namibia was import dependent for most of its energy needs with no domestic production of coal, gas, or oil. The hydroelectric dam at Ruancana provided 249 megawatts of generating capacity, and an additional 600 megawatt hours was imported from South Africa under arrangements with Eskom of South Africa and the South African Power Pool. The country's hopes for meeting future energy requirements rested on the development of its hydroelectric potential and of extensive known offshore gas reserves. Shell Exploration and Production Namibia B.V. (75%), Texaco Namibia Resources (12.5%), and Energy Africa Ltd. (12.5%) held the rights to the offshore Kudu gasfield. The Government and Shell have been examining the possibility of developing this resource for more than 6 years, but have been unable to work out a satisfactory combination of financing and supporting projects to justify the multibillion dollar investment required for its development. During 2001 and early 2002, Shell planned to drill up to four appraisal wells to try and establish recoverable reserves of 140 billion to 225 billion cubic meters of natural gas needed to justify a development project. It was also conducting a prefeasibility study on building the world's first floating liquified natural gas (FLNG) barge. The FLNG barge would be able to produce 4.8 Mt/yr of liquified natural gas and to store 240,000 cubic meters of liquid cargo. An investment decision was expected by late 2002 (Namibia Economist, 2002§).

Outlook

The long tradition of mining in Namibia is being given a substantial renewal with the reopening of the Tsumeb mines and smelter in 2000, the opening of the new Skorpion zinc project in late 2002, and the continued success of offshore diamond exploration and development. These successes are encouraging further exploration for base metals and diamond. Although offshore diamond production has experienced some setbacks in 2001 and early 2002 owing to technical or business reasons, the diamond potential remains strong. Such new mine developments, along with the potential for new value-added manufacturing, metal-processing, and gemstone cutting and polishing industries, are expected to keep the mineral sector a central part of the economy of Namibia for the foreseeable future. The Government's ability to attract new investment to harness the natural gas and hydroelectric power potential of the Kunene River will strongly influence future economic growth. In the longer run, greater development of regional transportation infrastructure in northern Namibia stimulated by the completion of the recent trans-Kalahari and trans-Caprivi highways, could see Walvis Bay become a significant export route for new mineral developments in Angola and in the landlocked countries of Botswana and Zambia. With a climate that is among the driest in the world, Namibia will continue to deal with the lack of water resources as a constraint on development.

References Cited

Anglo American plc, 2002, Reserves and resources, *in* Annual report 2001: London, United Kingdom, Anglo American plc, p. 64.

Chamber of Mines of Namibia, 2002, Annual report of the Chamber of Mines of Namibia for 2001: Chamber of Mines of Namibia, 36 p.

Namdeb Diamond Corp. (Pty.) Ltd., 2002, Review of operations—Annual review 2001: Windhoek, Namibia, Namdeb Diamond Corp. (Pty.) Ltd., 36 p.

Internet References Cited

Afri-Can Marine Minerals Corp., 2002, Annual report 2002, accessed May 28, 2003, at URL http://www.Afri-CanMarine.com/financials.shtml.

AngloGold Limited, 2002, East and West Africa—Navachab, Operational Review, accessed January 2, 2003, at URL http://anglogold.co.za.

Bank of Namibia, 2002, Table V.1—Current account (a), Annual Report 2001, accessed January 22, 2003, at URL http://www.bon.com.na/annual_report.htm.

Central Intelligence Agency, 2002, Namibia, World Factbook 2002, accessed December 5, 2002, at URL http://www.odci.gov/cia/publications/Factbook/geos/wa.html#Econ.

Diamond Fields International Ltd., 2001 (March 6), Diamond Fields and Trans Hex sign joint venture agreement, Press Release, accessed August 8, 2001, at URL http://www.diamondfields.com/s/NewsReleases.asp?ReportID=20327.

Diamond Fields International Ltd., 2002 (June 30), Financial reports—Auditors' report and consolidated financial statements—June 30, 2002 and 2001, 2002 annual report, accessed January 7, 2003, at URL http://www.diamondfields.com/s/Default.asp.

Mount Burgess Gold Mining Co. NL, 2002, Projects— Namibia—Tsumkwe diamond exploration, accessed August 8, 2002, at URL http://www.mountburgess.com/Tsumkwe.html.

Namdeb Diamond Corp. (Pty.) Ltd., [undated], Namdeb—Operations—Production information, accessed August 6, 2002, at URL http://www.namdeb.com/operations/opsProdFigures2000.asp.

Namibia Economist, 2002 (February 8), FLNG barge to Kudu, accessed January 7, 2003, at URL http://www.economist.com.na/2002/8feb/02-08-02.htm.

Namibian Minerals Corp., 2002 (March 28), Namibian Minerals Corporation announces fourth quarter and full year 2001 results, Press Release, accessed January 7, 2003, at URL http://www.newswire.ca/releases/March2002/28/c5596.html.

Ongopolo Mining & Processing Limited, 2001 (June 20), Agreement lays foundation for the future, Press Release, accessed July 7, 2001, at URL http://www.ongopolo.com.na/html/news/story_1.htm.

Digitized by Google

Ongopolo Mining & Processing Limited, 2002a (January 8), Slag heap bonanza for Ongopolo, Press Release, accessed February 9, 2002, at URL http://www.ongopolo.com.na/html/news/story_5.htm.
Ongopolo Mining & Processing Limited, 2002b, About us—Reserves, accessed November 20, 2002, at URL http://www.ongopolo.com.na/html/about/reserves.htm.
Reefton Mining N.L., 2002, Annual report for the financial year ending June 30, 2002, accessed December 8, 2002, at URL http://www.reeftonmining.com.au.
Rössing Uranium Ltd., 2002, Operations overview, accessed August 5, 2002, at URL http://www.rossing.com/operate.htm.
Uranium Information Center, 2002 (July), World uranium mining, Nuclear Issues Briefing Paper 41, accessed August 1, 2002, at URL http://www.uic.com.au/nip41.htm.
ZincOx Resources Plc, 2002, Namibia—Projects—Tsumeb slags, accessed December 22, 2002, at URL http://www.zincox.com/Tsumeb.htm.

Major Sources of Information

Association of Prospectors and Miners of Namibia
P.O. Box 5059
Windhoek, Namibia
Telephone: (264) 61 34978
Fax: (264) 61 32809

The Chamber of Mines of Namibia
P.O. Box 2895
Windhoek, Namibia
Telephone: (264) 61 237-925/926
Fax: (264) 61 222-638
E-mail: chammin@mweb.com.na

Geological Survey of Namibia
Private Bag 2168, 1 Aviation Road
Windhoek, Namibia
Telephone: (264) 61 208-5111
Fax: (264) 61 249-146
Internet: http://www.gsn.gov.na

Ministry of Mines and Energy
Private Bag 13297
1 Aviation Road
Windhoek, Namibia
Telephone: (264) 61 226-571 or 284-8111
Fax: (264) 61 238-643

Ministry of Trade and Industry
Private Bag 13340
Windhoek, Namibia
Telephone: (264) 61 229-933
Fax: (264) 61 220-227
Internet: http://www.republicofnamibia.com

Namibia National Small Miners Association
P.O. Box 7289
Windhoek, Namibia
Telephone: (264) 61 31088
Fax: (264) 61 31188

Major Publications

Chamber of Mines of Namibia, Annual Report.
Geological Survey of Namibia, 1992. The Mineral Resources of Namibia, 598 p.

Digitized by Google

TABLE 1
NAMIBIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000	2001
METALS						
Arsenic, white, 99% arsenic trioxide		1,297	175	--	--	914
Cadmium metal, refined		2	--	--	--	--
Copper:						
Mine output, concentrate (26% to 30% Cu):						
Gross weight		66,879	22,819	--	19,099 r/	44,332
Cu content		17,879	7,500 r/	--	5,620 r/ e/	12,392
Metal, blister 2/		24,997	8,014	--	5,082 r/	27,015
Gold	kilograms	2,417	1,882	2,005	2,417 r/	2,851
Lead:						
Mine output, concentrate:						
Gross weight		32,378	24,273	18,653	20,665 r/	26,182
Pb content		13,577	13,568	9,885	11,114	13,025
Metal, refined, primary 2/		1,530	236	--	--	--
Manganese, mine output, concentrate (44% Mn):						
Gross weight		39,671	--	--	--	--
Mn content		17,455	--	--	--	--
Silver, mine output, Ag content of concentrate	kilograms	41,000	22,670	9,670	9,287 r/	12,679
Uranium, U_3O_8 content of concentrate		3,775	3,257	3,171	3,201	2,640
Zinc, mine output, concentrate (49% to 54% Zn):						
Gross weight		72,816	78,617	70,620	73,535 r/	70,610
Zn content		39,658	42,274	35,140	39,126 r/	31,803
INDUSTRIAL MINERALS						
Cement e/		100,000	150,000	150,000	-- r/	--
Diamond:						
Gem e/	thousand carats	1,345 e/	1,394 e/	1,633	1,552 r/	1,490
Industrial e/	do.	71 e/	73 e/	--	--	
Total	do.	1,416	1,467	1,633	1,542	1,490
Fluorspar, acid grade (97% CaF_2) 3/		23,160	42,139	71,011	66,128	81,245
Gypsum		--	2,596	1,250	588	600 e/
Lithium minerals:						
Amblygonite		75	--	--	--	--
Lepidolite		275	--	--	--	--
Petalite		669	--	--	--	--
Total		1,019	500	--	--	--
Salt		492,780	507,361	503,479	576,000 r/	523,000
Semiprecious stones:						
Agate		175	161	95	96	95 e/
Amethyst	kilograms	23	--	--	4,850	4,000 e/
Chrysocolla	do.	--	900	--	--	--
Garnet	do.	5	429	--	134	130 e/
Quartz, crystal e/		--	--	--	--	--
Pietersite		--	--	--	20	20 e/
Rose quartz		220	454	--	74	70 e/
Sodalite		1,598	--	429	457	450 e/
Tourmaline	kilograms	53	--	--	390	400 e/
Stone:						
Dolomite		7,635	7,940	8,000 e/	--	--
Granite		6,675	6,665	5,866 r/	7,222	7,000 e/
Marble		13,743	9,020	11,221 r/ e/	24,426	20,000 e/
Sulfur, pyrite concentrate:						
Gross weight (49% to 51% S)		94,585	28,174	--	11,967	56,994
S content		46,476	12,855	--	5,704	28,606
Wollastonite		194	267	347	441	440 e/

e/ Estimated. r/ Revised. -- Zero.

1/ Table includes data available through November 30, 2002.

2/ Includes products of imported concentrate.

3/ Fluorspar production shown in wet metric tons; approximately 9% moisture.

Digitized by Google

Digitized by Google

THE MINERAL INDUSTRY OF

NIGERIA

By Philip M. Mobbs

According to world production data compiled by the U.S. Energy Information Administration (2002), Nigeria ranked 11th in the production of crude petroleum and condensate by volume. Nigeria, which was a member of the Organization of the Petroleum Exporting Countries, remained Africa's largest oil producer in 2001 with about 3% of world production compared with Libya (2%), Algeria (1.8%), and Egypt (0.9%) and was the fifth leading source of U.S. crude oil imports following Saudi Arabia, Mexico, Canada, and Venezuela.

With more than 126 million people, Nigeria was the most populous African nation. The International Monetary Fund (2002§[1]) estimated that the nation's nominal gross domestic product (GDP) was $41.9 billion[2]. The oil sector, which was the cornerstone of the Nigerian economy, provided most Government revenues and accounted for most of the country's export earnings.

Government Policies and Programs

The Department of Petroleum Resources concerns itself with the oil and natural gas segment of the mineral industry. The Ministry of Solid Minerals Development is involved in the promotion, exploration, and development of Nigeria's nonfuel minerals and coal. The Ministry of Power and Steel administers the iron and steel sector.

The Mining and Minerals Decree No. 34, which was enacted in 1999, reaffirms that all mineral rights are held by the Federal Government. Controversy surrounded the requests by individual producing States and local governments that the Federal Government reallocate total control of mineral resources to them. The contention of the coastal States that offshore oil resources (and revenues) should be attributed to them instead of the Federal Government made its way to the Nigerian Supreme Court. The issue remained unresolved at yearend.

In September, the Government announced that dormant mining licenses would be revoked and that new mining licenses would be restricted to companies and individuals with the "necessary experience and means." More than 1,000 licenses were considered to be dormant (Ogidan, 2001§).

Commodity Review

Metals

Aluminum.—Dates for reopening the 193,000-metric-ton-per-year (t/yr)-capacity smelter of Aluminium Smelter Co. of Nigeria Ltd. (ALSCON) at Ikot Abasi were frequently announced during 2001; the facility, which had suspended operations in 1999, remained closed at yearend. Negotiations for a new natural gas fuel contract for the smelter, which had been underway since 2000, were completed in July 2001 when the Nigerian Gas Co. agreed to supply 2.9 million cubic meters per day of natural gas for 3 years at about $0.018 per cubic meter of gas ($0.50 per thousand standard cubic feet). At the beginning of 2001, Ferrostaal AG of Germany, which held 30% equity interest in ALSCON compared with the Government's 70%, was slated to manage the smelter when operations restarted. At midyear, however, the Government began a search for a new technical partner to operate the ALSCON plant and reportedly was considering the construction of a second aluminum smelter (Metal Bulletin, 2001a-d; Daniel, 2001§; Guardian, 2001e§).

Steel.—Most of the production facilities of the primarily Government-owned steel sector were idle in 2001. The Government awarded Vsesojuznoje Importno-Exportnoje Objedieneije Tyazhpromexport of Russia a $500 million contract to complete the Ajaokuta Steel Co. Ltd. plant by 2003 (Steel Times International, 2001). The Government proposed to add a new $100 million 100,000-t/yr-capacity steel rail facility at the Ajaokuta complex (Ezereonwu, 2001§). The restoration of mill facilities of the Delta Steel Co. Ltd. plant at Aladja was under contract to Voest-Alpine Industrienlagenbau GmbH & Co. Renovation of Delta's melt shop was scheduled to be completed in 2002 (Metal Bulletin, 2001e). Of the three state-owned steel rolling mills, Katsina Steel Rolling Co. Ltd. restarted operations in April, and Oshogbo Steel Co. Ltd. resumed production in June.

In the Calabar Free Trade Zone, Bao-Yao Iron & Steel Ltd. of China reportedly was building a 180,000-to-200,000-t/yr steel plant. In joint venture with Futurex Nigeria Ltd., Bao-Yao also had a 22,000-t/yr-capacity concrete reinforcing bar plant under construction near Abuja (Metal Bulletin, 2001f; Essien, 2002§; This Day, 2000§).

Industrial Minerals

A number of industrial mineral projects were proposed or under construction in 2001. Cross Rivers State Business Council proposed the establishment of a barite-processing plant. Gemstone-cutting plants were proposed for Adamawa and Nawarawa States. The Ondo State Government rehabilitated the Oluwa Glass Factory. The Edo State Government proposed the development of a granite quarry and a marble-polishing factory. The Federal Government's Raw Materials Research and Development Council (RMRDC) proposed the

[1]References that include a section twist (§) are found in the Internet References Cited section.

[2]Where necessary, values for 2001 have been converted from Nigerian naira (NN) to U.S. dollars (US$) at the average rate of NN117=US$1.00.

Digitized by Google

establishment of a kaolin-processing plant at Gwarzo in joint venture with the Kano State Government. The RMRDC also built a phosphate-rock-processing plant in Ososun in joint venture with the Ogun State Government and had a soda ash plant under construction in joint venture with the Borno State Government. The Yobe State Government proposed the building of a soda-ash-processing plant at Yusufari.

Cement.—The Benue State Government disputed Dangote Industries Ltd. of Nigeria acquisition of the controlling interest in the Benue Cement Co. p.l.c. Dangote subsequently initiated a $150 million 11,000-metric-ton-per-day-capacity cement plant in Calabar (Agboh, 2001§; Ben-Akpan, 2002§). After acquiring 40% interest in the Cement Company of Northern Nigeria (CCNN) in 2000, Scancem International ANS of Norway invested more than $7.4 million in the rehabilitation of CCNN's cement plant at Sokoto (Meya, 2001§).

Mineral Fuels

Bitumen.—Development of the bitumen deposits in southwestern Nigeria remained stalled. In 1999, a Government committee had received bids on the 15 bitumen exploration and development blocks offered, but leases were not assigned nor were licenses issued. In 2000, the Government had reviewed the lease sale, and in 2001, the Ministry of Solid Minerals Development initiated an investigation of the bitumen project committee. In August 2001, Conoco Energy Nigeria Ltd. was awarded a year-long contract to undertake a seismic survey of the bitumen project area. The Government anticipated that development leases could be tendered for bids in 2003 (Guardian, 2001b§).

Natural Gas.—Nigeria continued to promote the commercialization of natural gas to eliminate the decades-old practice of burning off the gas in the oilfields. In July, the Ministry of the Environment announced that the Government had reset the national deadline for the elimination of flaring natural gas in 2004. In October, however, the Government delayed the proposed target date to eliminate gas flaring to 2008 (Akinmutimi, 2001§; Guardian, 2001c§, d§).

In 2001, the private industry developers of the West African Gas Pipeline continued to attempt to secure buying agreements from the Government-owned power companies in Benin, Ghana, and Togo that were expected to use the gas. The Governments of Algeria and Nigeria proposed to construct a 4,000-kilometer natural gas pipeline from Nigeria to coastal Algeria for subsequent transport of Nigerian gas to Europe at a cost of $5 billion to $7 billion (Oil & Gas Journal, 2001b).

A third natural gas liquefaction train was under construction at Nigeria Liquified Natural Gas Ltd.'s (NLNG) plant at Finima on Bonny Island. Installation of the fourth and fifth liquified natural gas (LNG) trains at NLNG were under evaluation. The Government signed memorandums of understanding for feasibility studies of the Brass LNG and the West Niger Delta LNG projects. Brass LNG, which was a 5-million-metric-ton-per-year (Mt/yr)-capacity project under consideration by the joint venture of Nigerian Agip Oil Co. (20% equity interest), Nigerian National Petroleum Corp. (NNPC) (60%), and Phillips Oil Co. Ltd. (20%), was proposed to be operational by 2007 (Phillips Petroleum Co., 2001§). West Niger Delta LNG was to be developed by a joint venture of Exxon-Mobil Producing Nigeria Unlimited, Chevron Nigeria Ltd.—Texaco Overseas Petroleum Co., and Conoco Energy Nigeria. The proposed 9-Mt/yr plant was to be operational by 2008 (Pravda, 2002§). All three LNG projects could be chasing the same customers for long-term gas-supply contracts.

In 2001, NNPC and Chevron Nigeria agreed to a joint venture for the construction of a gas-to-liquids projects at Escravos. The 34,000-barrel-per-day (bbl/d) facility was expected to be operational in 2005 (Africa Energy Intelligence, 2001).

Petroleum.—For most of 2001, all four of NNPC's crude oil refineries were operational. Production from the Kaduna and the Warri refineries was temporarily suspended in late October to repair vandalized crude oil input pipelines (Guardian, 2001f§). Operations at the Kaduna refinery again were suspended in late November to repair damage caused by a fire.

In 2001, the Government released guidelines for the approval and development of privately owned crude oil refineries. A 12,000-bbl/d refinery was proposed to be constructed for Amakpe International Refineries Ltd. at Qua Iboe, Akwa Ibom State (Oil & Gas Journal, 2001a). Akwa Ibom Refinery and Petrochemicals Co. Ltd., which was a joint venture of LYK Engineering Ltd. (51% equity interest), China Petroleum & Chemical Corp. (10%), the Akwa Ibom State Government, and private investors proposed to construct a 100,000-bbl/d refinery in Ikot Abasi, Akwa Ibom State (Guardian, 2001a§).

General background coverage of the oil and gas sector in Nigeria is available from the U.S. Energy Information Administration at their Web site (U.S. Energy Information Administration, 2002§).

References Cited

Africa Energy Intelligence, 2001, Nigeria—Go-ahead for EGTL scheme: Africa Energy Intelligence, no. 305, September 5, p. 4.

Metal Bulletin, 2001a, Alscon prepares for ramp up: Metal Bulletin, no. 8597, August 6, p. 5.

Metal Bulletin, 2001b, Alscon signs gas sales and purchase agreement: Metal Bulletin, no. 8595, July 26, p. 5.

Metal Bulletin, 2001c, Alscon to restart: Metal Bulletin, no. 8539, January 8, p. 14.

Metal Bulletin, 2001d, Alscon to resume production by May: Metal Bulletin, no. 8544, January 25, p. 8.

Metal Bulletin, 2001e, Delta Steel rolling mill nears restart of production: Metal Bulletin, no. 8577, May 24, p. 20.

Metal Bulletin, 2001f, New Nigerian steelworks sets April start-up: Metal Bulletin, no. 8549, February 12, p. 20.

Oil & Gas Journal, 2001a, Quick takes: Oil & Gas Journal, v. 99, no. 11, March 12, p. 8.

Oil & Gas Journal, 2001b, Quick takes: Oil & Gas Journal, v. 99, no. 38, September 17, p. 8.

Steel Times International, 2001, Nigerian steel reactivated: Steel Times International, v. 25, no. 3, May, p. 8.

U.S. Energy Information Administration, 2002, Table 3.3a-h—Petroleum imports from [various countries]: Monthly Energy Review, August, p. 48-55.

Internet References Cited

Agboh, Sisaa, 2001 (January 19), BCC—'No pact with Dangote,' Post Express Wired, accessed February 12, 2001, via URL http://www.postexpresswired.com.

Digitized by Google

Akinmutimi, Tola, 2001 (July 25), Gas flaring—Erring firms may lose licences, Guardian, accessed July 25, 2001, at URL http://www.ngrguaridannews.com/news2/nn827305.html.
Ben-Akpan, Anietie, 2002 (January 23), Dangote sets up $150m cement plant, Guardian, accessed January 23, 2002, at URL http://www.ngrguardiannews.com/business2/bn846501x.html.
Daniel, Alifa, 2001 (June 8), Nigeria—British firm discuss new N200b aluminium plant, Guardian, accessed June 8, 2001, at URL http://www.ngrguardiannews.com/news2/nn823916.html.
Essien, Ufot, 2002 (January 12), EPZ—From dream to reality, This Day, accessed November 6, 2002, at URL http://www.thisdayonline.com/archive/2002/01/12/20020112spe01.html.
Ezereonwu, Jane, 2001 (March 13), Ajaokuta complex gets $100m facility for railing steel, Guardian, accessed March 13, 2001, at URL http://www.ngrguardiannews.com/news2/nn815210.html.
Guardian, 2001a (March 23), Akwa Ibom to build refinery, Guardian, accessed March 23, 2001, at URL http://www.ngrguardiannews.com/news2/nn816026.html.
Guardian, 2001b (March 29), Exploitation of bitumen begins next year, Guardian, accessed March 29, 2001, at URL http://www.ngrguardiannews.com/business2/ bn816812.html.
Guardian, 2001c (October 23), Govt extends zero gas flareing deadline to 2008, Guardian, accessed October 23, 2001, at URL http://www.ngrguardiannews.com/news2/nn837307.html.
Guardian, 2001d (October 1), Govt restates commitment to zero gas flare deadline, Guardian, accessed October 1, 2001, at URL http://www.ngrguardiannews.com/news2/nn835103.html.
Guardian, 2001e (June 14), Govt shops for technical partners for ALSCON, Guardian, accessed June 14, 2001, at URL http://www.ngrguardiannews.com/business2/bn824591.html.
Guardian, 2001f (November 21), Kaduna refinery resumes operation—As NUPENG assures on fuel supply, Guardian, accessed November 28, 2001, at URL http://www.ngrguardiannews.com/energy/eg840204.html.
International Monetary Fund, 2002 (September), Gross domestic product—Current prices, World Economic Outlook Database, accessed October 28, 2001, at URL http://www.imf.org/external/pubs/ft/weo/2002/02/data/index.htm.
Meya, Eric, 2001 (May 14), Core investor sinks N888 million in Sokoto Cement, Guardian, accessed May 14, 2001, at URL http://www.ngrguardiannews.com/business2/bn821401.html.
Ogidan, Ade, 2001 (September 20), Govt restricts issuance of mining licences, Guardian, accessed September 20, 2001, at URL http://www.ngrguardiannews.com/business2/bn833002.html.
Phillips Petroleum Co., 2001 (September 7), Co-venturers and Nigerian Government agree to study development of LNG facility, accessed November 7, 2002, at URL http://phillips66.com/newsroom/Newsreleases/rel356.html.
Pravda, 2002 (May 21), Nigeria set for further LNG plants, Pravda, accessed November 7, 2002, at URL http://english.pravada.ru/comp/2002/05/21/29046.html.
This Day, 2000 (September 26), Steeling up to success, This Day, accessed November 5, 2001, at URL http://www.thisdayonline.com/archive/2000/09/26/20000926BUS03.html.
U.S. Energy Information Administration, 2002 (January), Nigeria, Country Analysis Brief, accessed February 6, 2002, at URL http://www.eia.doe.gov/emeu/cabs/nigeria2.html.

Major Sources of Information

Ministry of Solid Minerals Development
New Secretariat Complex
Annex 3, 5th Floor
Abuja, FCT, Nigeria
Telephone: (234-9) 523-9063
Fax: (234-9) 523-5830

Ministry of Power and Steel
Federal Secretariat Complex
Annex 3, Shehu Shagari Way
Abuja, FCT, Nigeria
Telephone: (234-9) 523-7064
Fax: (234-9) 523-6652

Other Publications

Nigeria Ministry of Solid Minerals Development, 1996, Solid minerals development in Nigeria: Abuja, Nigeria, Ministry of Solid Minerals Development, 34 p.
Nigeria Ministry of Solid Minerals Development, 1998, Mineral occurrences in Nigeria: Abuja, Nigeria, Ministry of Solid Minerals CD-ROM.

Digitized by Google

TABLE 1
NIGERIA : ESTIMATED PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/		1997	1998	1999	2000	2001
METALS						
Aluminum		2,500	20,000	16,000	--	--
Columbium and tantalum concentrates:						
Gross weight		60 4/	70	70	80	70
Columbium content		23	30	30	35	30
Gold	kilograms	6	10	10	10	10
Iron and steel:						
Iron ore, gross weight	thousand tons	50	--	--	--	--
Steel, crude	do.	--	2	--	--	--
Lead, metal, refined	do.	4	5	5	5	5
Tin:						
Mine output, cassiterite concentrate:						
Gross weight		150	200	200	300	200
Sn content		100	130	130	200	130
Metal, smelter		100	150	50	25 r/	25
INDUSTRIAL MINERALS						
Barite 5/		4,000	5,000 4/	5,000	5,000	5,000
Cement, hydraulic	thousand tons	2,520	2,700	2,500	2,500	3,000
Clays:						
Kaolin		100,000	110,000	110,000	110,000	110,000
Unspecified		100,000	100,000	100,000	100,000	100,000
Feldspar		1,000	500	500	600	600
Gypsum		300,000	300,000	200,000	200,000 r/	200,000
Nitropen:						
N content of ammonia	thousand tons	134	167	148	--	--
N content of urea	do.	41	105	100	--	--
Stone:						
Limestone	do.	2,000	2,000	2,000	2,000	2,000
Marble	do.	30	30	30	30	30
Shale	do.	500	500	500	500	600
Topaz	kilograms	1,000	1,700	2,500	2,000	2,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous		7,000	30,000	30,000	35,000	35,000
Gas, natural:						
Gross	million cubic meters	30,000	30,000	30,000	30,000	35,000
Dry	do.	5,400	6,000	7,000	13,000	21,000
Petroleum:						
Crude	thousand 42-gallon barrels	845,000	788,000	777,000	783,000	823,000
Refinery products:						
Gasoline	do.	47,800	18,300	10,000	25,000	27,000
Jet fuel	do.	3,650	2,200	1,000	2,000	3,000
Kerosene	do.	21,200	6,200	6,000	10,000	12,000
Distillate fuel oil	do.	22,300	18,300	9,000	20,000	21,000
Residual fuel oil	do.	28,100	11,700	12,000	18,000	22,000
Unspecified	do.	15,300	17,500	5,000	15,000	15,000
Total	do.	138,000	74,200	43,000	90,000	100,000

r/ Revised. -- Zero.

1/ Includes data available through November 4, 2002.

2/ Estimated data are rounded to no more than three significant digits; may not add to totals shown.

3/ In addition to the commodities listed, amethyst, aquamarine, bitumen, diamond, emerald, garnet, granite, lead, phosphate rock, ruby, sapphire, soda ash, talc, tourmaline, tungsten, zinc, and zircon are mined, and a variety of crude construction materials (stone, sand and gravel) are produced, but information is inadequate to estimate output.

4/ Reported figure.

5/ Considerably more barite is produced but is considered to be commercially unusable.

Digitized by Google

THE MINERAL INDUSTRY OF

SOUTH AFRICA

By George J. Coakley

The Republic of South Africa holds a major economic and physical presence on the African continent. Its rich natural resource endowment serves as a base for one of the strongest economies in Africa with a per capita gross domestic product (GDP), of $9,400[1] per capita based on purchasing power parity data for 2000. It ranks fifth in population and land area on the continent with 43.6 million people and 1,219,912 square kilometers, respectively. During 2001, its export-oriented economy was affected by the slowdown in the world economy with real GDP growth declining to 2.2% from 3.4% in 2000 (International Monetary Fund, 2003§[2]). Following a 25% devaluation of the rand against the U.S. dollar in 2000, the rand dropped another 50% in 2001 going from a monthly average of 7.78 rand to the dollar in January to 11.59 rand in December 2001. The depreciated rand, however, helped the international competitiveness of South African exports.

Reporting on the economic impact of HIV/AIDS in South Africa, the International Monetary Fund (2003, p. 19) highlighted the seriousness of this pandemic. HIV infected more than 5 million people (11% of the population) in South Africa and 20% of the working-age population in 2001. The report forecasts that "without drastic policy measures and changes in social behavior, HIV/AIDS can be expected to continue spreading and to take a heavy toll on the population and the labor force. Between now and 2010, around 10% to 15% of the population could die from AIDS-related diseases: population and labor force growth could slow to zero compared with a non-HIV/AIDS baseline projection of 1.5%; life expectancy could drop to 38 years from the current level of close to 54 years; and the HIV infection rate could reach 15% of the population and 25% of the labor force." This has significant implications for a mining industry that employed 2.7% of the population or approximately 407,000 workers in 2001. This did not include an additional 50,000 to 60,000 workers employed in the processing industries, such as aluminum, cement, ferroalloys, and steel.

According to the South Africa Department of Minerals and Energy (2002, p. 6-21), South Africa produced more than 55 different mineral commodities from about 749 mines and quarries, including 71diamond, 55 coal, 35 gold, and 11 platinum-group metals (PGM) operations in 2001. It ranks first in the world in production of andalusite (aluminosilicates), chromite, ferrochrome, gold, PGM, vanadium, and vermiculite. It is also a major world supplier of antimony, ferromanganese, manganese, titanium, and zirconium. Mining and quarrying contributed $7.8 billion, or 7.5%, to the GDP in 2001 and accounted for 34.3% of all merchandise trade. Export sales had been historically dominated by gold until 2000 and 2001 when, as a result of declining gold prices and production and increased PGM production and prices, PGM were the leading export by value. In 2001, PGM export sales were $3.9 billion compared with $3.39 billion for gold exports. The next leading exports were coal at $3.1 billion and diamond. Although diamond export data are not published, the value of rough diamond production is estimated to be more than $1 billion. In addition to exports of mining and quarrying products, value-added processed mineral products worth $2.2 billion were exported in 2001; of this total, ferroalloys accounted for $873 million, and aluminum, for $661 million. Imports for 2001 included $4.38 billion of primary and processed mineral products (primarily industrial mineral products, nonferrous metals, and diamond), and $3.74 billion in petroleum and petroleum products that resulted in a net positive mineral and fuel merchandise trade balance of about $1.9 billion.

The most important mineral commodities produced in South Africa, in terms of value, were PGM, gold, coal, ferroalloys (ferrochromium, ferromanganese, ferrosilicon, and ferrovanadium), aluminum, steel, titanium, iron ore, diamond, vanadium, and copper. Additionally, important output of metallic commodities included antimony, chromite, cobalt, lead, manganese, nickel, silver, uranium, zinc, and zirconium. Significant industrial minerals production included andalusite, aggregate and sand, asbestos, dimension stone, fluorspar, limestone and lime, phosphate rock, sulfur, and vermiculite. South Africa was a major producer and the world's third largest exporter of coal and the largest producer of synthetic liquid fuels and petrochemicals derived from coal. South Africa's well-developed railway and port infrastructure served the domestic minerals industry and those in neighboring countries.

Government Policies and Programs

The Ministry of Mines and Energy's Department of Minerals and Energy (DME) is the primary Government entity responsible for the establishment and implementation of minerals and energy policy and for oversight of the country's mineral industry. Within the DME are the Mineral Development Branch, which is responsible for regional mineral development, minerals economics (Minerals Bureau), mine rehabilitation, and mining rights; the Energy Branch, which promotes the optimum use of energy resources; and the Mine, Health & Safety Inspectorate. Associated with the DME are a number of parastatal institutions, which included the Atomic Energy Corp.; the Council for Nuclear Safety; the Council for Geosciences (formerly the Geological Survey of South Africa); the Council for Mineral Technology (Mintek), the parastatal mineral-research organization; the National Electricity Regulator; the South African Diamond Board; and the Central Energy Fund

[1]Where necessary, values have been converted from South African rands (R) to U.S. dollars at the rate of R8.60=US$1.00 for 2001 and R6.94=US$1.00 for 2000.

[2]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

(Pty.) Ltd. (CEF), through which the State's interest in the liquid fuel industry is owned, developed, and managed commercially.

Following 5 years of public and internal Government debate, the DME published its Minerals Development Draft Bill in the Government Gazette of December 18, 2000. The draft bill was open to public comment through March 31, 2001. The Minerals Development Draft Bill will give the State exclusive custodianship of all mineral rights and focused on the freeing up of unexploited mineral rights long held by the major mining houses to provide more opportunities in the mining sector for black South African entrepreneurial groups and for foreign investment. The introduction to the bill states, "The fundamental principles which underpins this Bill are

"a. mineral resources is the common heritage of all South Africans and belongs collectively to all the peoples of South Africa;

"b. it is a universally recognized right of a State to exercise full and permanent sovereignty over all it natural resources;

"c. public trusteeship of South Africa's mineral resources;

"d. to redress the results of past racial discrimination and ensure the historically disadvantaged persons participate in the minerals and mining industry and benefit from the exploitation of the nation's mineral resources;

"e. security of tenure for prospecting and mining operations;

"f. environmental protection and sustainable development; and

"g. promotion of local and rural economic development and social upliftment of communities affected by mining.

"The minerals and mining law dispensation proposed in the draft bill is based on the universally accepted principle that mineral resources are part of South Africa's national patrimony and that the State is the custodian of the nation's mineral resources. It is from the aforementioned principles that the State derives its entitlements to control, administer, manage access to South Africa's mineral resources, and to grant prospecting rights and mining rights and issue retention permits.

"Therefore, on commencement of the new legislation, prospecting rights, mining rights, retention permits, and permission to remove minerals will only be granted by the State. As far as possible, the bill reduces ministerial discretion by ensuring that discretionary powers are exercised based on prescribed criteria." The full text of the Minerals Development Draft Bill, 2000, is accessible at URL http://www.polity.org.za/govdocs/notices/2000/not4577.html. Draft legislation incorporating public comments on the Bill was expected in early 2002.

In its initial reaction to the Minerals Development Draft Bill, 2000, the Chamber of Mines, which represents the largest sectors of the South African mining industry, supported the underlying objectives of the bill but expressed concern over the legislation's ability to achieve these objectives without "unintended negative consequences." The Chamber argued that the Bill would "1. Undermine fundamental property rights. 2. Give excessive discretion to a single person (the Minister of Mines and Energy). 3. Offer no right of appeal to the courts. 4. Create legislative and regulatory uncertainty. 4. Make it more onerous to meet licence requirements and 5. Introduce a royalty system that could put thousands of jobs at risk." The Chamber was concerned by the lack of clarity on compensation for expropriated properties and the impact proposed taxes could have on production costs and the international competitiveness of the industry (South Africa Chamber of Mines, 2001§).

Subject to the enactment of the new Mineral Development Bill by Parliament, the South African mineral industry operated under the Mining Titles Registration Act, 1967; the Central Energy Fund Act, 1977; the Petroleum Products Act, 1977; the Diamonds Act, 1986; the Electricity Act, 1987; the Mineral Technology Act, 1989; the Minerals Act, 1991; the Minerals Amendment Act, 1993; the Nuclear Energy Act, 1993; the Liquid Fuels and Oil Repeal Act, 1993; the Mineral and Energy Laws Rationalization Act, 1994 (which repealed the Mining Rights Act of 1967); and the Mine Health and Safety Act, 1996. A 1998 ruling by the Minister of Finance set the corporate tax rate at 35% for all companies entering offshore oil and gas subleases with Soekor (Pty.) Ltd. by the end of 1999.

Environmental Issues

The Department of Environmental Affairs and Tourism (DEAT) is the focal point for environmental planning and management within South Africa. The DEAT has been developing a comprehensive set of geospatial data and environmental indicators for use in national environmental and land-use planning and resource management, which are accessible through its Web site at URL http://www.environment.gov.za. The DEAT implements the National Environmental Management Act (107 of 1998) (NEMA) which created a framework for environmental management in South Africa. It established principles for sustainable development, procedures for coordinating the environmental functions of government, and mechanisms for civil society participation.

As required under NEMA, the DME put in place the Environmental Management Plan, which addressed mineral sector issues, during 2000. The plan is available on its Web site through a drop-down menu under "Publications" at URL http://www.dme.gov.za.

Production

In 2001, South Africa was one of the largest and most diverse minerals producer in the world. Mineral production statistics are listed in table 1. For 2001, the DME Minerals Economics Directorate (Minerals Bureau) reported the value of primary mined products at $13.39 billion and of processed mineral materials at $2.85 billion. In addition, hydrocarbons, which was valued at $251 million, were produced in 2001. The mining and quarrying sector paid out $2.8 billion in wages and more than $675 million in taxes to the Government. Base on value, about 22% of primary mined products and 23% of processed mineral materials were consumed domestically in 2001. Coal exports remained constant between 2002 and 2001 at approximately 68 million metric tons (Mt). In 2001, 89 Mt of domestic coal production went for internal power generation and 48 Mt for value-added synthetic fuel and petrochemicals production. Using South Africa's natural comparative advantage in its mineral resource endowment of chromite, coal, iron ore, manganese, and nickel, these materials were also converted to value-added ferroalloy and steel products for world markets (South Africa Department of Minerals and Energy, 2002, p. 6-14).

Digitized by Google

Trade

In 2001, the total value of sales of primary minerals, as reported by the DME Minerals Economics Directorate (Minerals Bureau), was $16.24 billion, of which $12.65 was exported, compared with $14.2 billion and $11 billion, respectively, in 2000. For 2001, the total value of all processed mineral materials was $2.85 billion, of which $2.2 billion was exported. The major exports by value in 2001 were gold at $3.39 billion; PGMs, $3.39 billion; coal, $1.98 billion; ferroalloys, $870 million; aluminum, $661 million; iron ore, $400 million; and vanadium, $103 million. Other significant exports, for which individual value data were not provided included diamond, steel, titanium, and zirconium.

The majority, by value, of primary mineral exports, which included precious minerals, went to European markets followed by the Pacific Rim countries, the Middle East and Near East, and North America and Central America, with less than 10% each. Exports within Africa accounted for less than 1% of the South African mineral export trade.

Although South Africa was self-sufficient in the vast majority of its mineral needs, an increasing amount of mineral commodities was being imported. Significant mineral imports included alumina, coking coal, rough and cut diamond, certain ferroalloys, magnesite, magnesia, nickel, precious metals, and sulfur. Imports of primary and processed mineral products in 2001 totaled $5.37 billion with an additional $3.37 billion in crude petroleum imports reported (South Africa Department of Minerals and Energy, 2002, p. 14-21).

Structure of the Mineral Industry

The South African minerals and energy industries operated on a free enterprise, market-driven basis. Ownership of mineral rights was held by either the Government or private entities. Mineral rights would revert to the state under the terms of the draft Minerals Development Bill, 2000. Government involvement in these sectors was minimal and primarily confined to ownership of the national electric power utility Eskom and the national oil and gas exploration company Southern Oil Exploration Co. (Soekor), including additional declining subsidies provided to synthetic fuels programs of the two parastatals Mossgas (Pty.) Ltd. and Sasol Limited. Sasol receives a subsidy when the derived price of oil (a figure calculated by the Government monthly following oil price swings), falls below $16 a barrel.

In South Africa, the bulk of mineral land holdings and production had been historically controlled by five mining investment houses. Since 1994, however, the industry has undergone a major corporate restructuring, or "unbundling," aimed at simplifying a complex system of interlocking ownership that existed in the past, establishing separate core-commodity-focused profit centers, and diversifying and rationalizing nonperforming assets to make the newly restructured companies more competitive internationally. The structure and ownership of the industry as of mid-2002 are listed in table 2.

In mid-2001, the Government approved the $19 billion takeover of De Beers Consolidated Mines Ltd. (De Beers) by Anglo American plc (Business Day, 2001§). The Chamber of Mines, whose members represent the majority of coal, gold, and uranium producers, was responsible for a variety of advisory and service functions for mining interests in South Africa. One of its main activities was the annual wage negotiations between member mines and the National Union of Mineworkers.

Commodity Review

Metals

Aluminum.—Because South Africa has no economically exploitable deposits of bauxite and no alumina production capacity, all alumina feedstock for the production of aluminum metal was imported. BHP Billiton Aluminium South Africa Ltd. was the sole producer of primary aluminum from its Bayside smelter and the newer Hillside smelter at Richards Bay. For the fiscal year ending June 30, 2002, and despite a power outage in September 2001 that resulted in 12,500 metric tons (t) of lost production, the Hillside smelter increased production slightly to 502,000 t of aluminum metal compared with 498,000 t in the previous fiscal year. Production at the Bayside smelter dropped slightly to 174,000 t of aluminum from 178,000 t in fiscal year 2000-01. In April 2002, BHP Billiton will begin construction on the $449 million Hillside III Expansion Program, which will expand Hillside smelting capacity by another 132,000 metric tons per year (t/yr) of aluminum by 2002 (BHP Billiton plc, 2002a, p. 14§). At that time, aluminum smelting capacity in Mozambique and South Africa will represent about 5% of world production capacity.

Antimony.—Metorex Ltd. (a subsidiary of Crew Development Corp. of Canada, which operated the Consolidated Murchison Mine near Gravelotte in Northern Province) was South Africa's only producer of antimony (as stibnite concentrate); its output of about 8% of world production made South Africa the second largest producer after China. The mine hoists ore from three shafts—Athens, Beta, and Monarch. Production from the reequipped Beta shaft resumed in the first quarter of 2001. For the fiscal year ending June 30, 2002, Consolidated Murchison treated 35,000 metric tons per month (t/mo) averaging 1.4% antimony and 1.91 grams per metric ton (g/t) gold. Recovery rates were 87.55% for antimony and 97.65% for gold. With recommissioning of the Beta shaft in 2001, production of stibnite concentrates increased by 36% compared with that of the previous year to 9,570 t and contained an average of 59% antimony; lower grades reduced gold production 17% to 903 kilograms (kg) of gold. As of June 30, 2002, proved and probable reserves amounted to 1.7 Mt at 2.0% antimony and 2.0 g/t gold inclusive of 15% dilution and a mine call factor of 85%. Mineral resources exclusive of reserves total 8.5 Mt at grades of 2.5% antimony and 2.7 g/t gold (Metorex Ltd., 2002a§).

Chromite and Ferrochromium.—Chromite ore production decreased by 17% in 2001 to 5.5 Mt as the industry responded to reduced demand and a selloff of excess stocks. South Africa was the global leader in chromite ore production and export. Production came from more than 20 mines located within the Bushveld Ultramafic Complex. About 85% of the ore went to

Digitized by Google

supply domestic ferrochrome smelters, and the remainder was exported. Domestic consumption of chromite ore, which was the highest in the world, fed the world's leading ferrochrome industry as well as one of the world's major chromium chemicals and refractories industries. In 2001, chromite ore sales were valued at about $117 million, of which about $44 million was export revenue (South Africa Department of Minerals and Energy, 2002, p. 108-111).

For the fiscal year ending June 30, 2002, BHP Billiton plc's Samancor Group, which was the world's largest integrated ferroalloys producer, produced 2.4 Mt of chromite ore and 837,000 t of chrome alloys compared with 3.16 Mt of chromite ore and 908,000 t of chrome alloys in the previous fiscal year. Samancor's operations were organized under two mining centers—Eastern Chrome Mines, based at Steelpoort, and Western Chrome Mines, with its mine office at Mooinooi, near Rustenburg. As part of a restructuring and cost-reduction program, the Palmiet Ferrochrome facility was closed in late 2001, a new pelletizing plant was opened at Tubatse, and two new 85,000-t/yr-capacity ferrochrome furnaces were commissioned at the Wonderkop Joint Venture in mid-2001 (BHP Billiton plc, 2002b§, p. 12, 24).

Responding to weak markets during 2001, Xstrata AG (controlled by the Swiss metal-trading company Glencore International AG) limited ferrochrome production to 860,600 t to avoid a stock buildup and idled four ferrochrome furnaces in 2001 following the closure of two furnaces in 2000. Production levels in 2001 represented about a 66% capacity utilization of its three smelting operations at Lydenburg, Rustenburg, and Wonderkop. Production of salable chrome ore for the year decreased to 1.5 Mt from 1.9 Mt in 2000. The company's four captive chrome mines provided about 74% of feed to Xstrata ferrochrome plants with additional feed, which included chrome-bearing tailings from platinum mines, purchased locally. In March 2002, Xstrata was scheduled to transfer all its assets and liabilities to the newly formed Xstrata plc; Glencore will retain a 40% controlling share (Xstrata AG, 2002b, p. 5-6).

In May 2001, the Associated Manganese Mines of South Africa Limited formally changed its name to Assmang Limited. Assmang was jointly controlled by Anglovaal Mining Limited and Assore Limited. Its Chrome Division operated the Dwarsrivier chrome mine and the Machadodorp ferrochrome works, both of which are in Mpumalanga. Its $44 million 54-megavoltampere furnace and a 350,000-t/yr chromite pelletizing plant at Machadodorp were commissioned during 2001. For the financial year ended June 30, 2002, Assmang produced 39,000 t of chromite ore plus 159,000 t of charge chrome that originated from the Dwarsrivier Mine (Assmang Ltd., 2002b§).

Copper.—Palabora Mining Company Limited (owned by Rio Tinto plc.) operated the largest integrated copper complex in South Africa. Progress continued on the transition of the operations from an 80,000-metric-ton-per-day (t/d) open pit mine to a 30,000-t/d underground mine now scheduled for full startup in November 2002. Open pit mining will stop in April 2002. The $380 million underground development project will extend the life of the mine for another 20 years. During 2001, the volume of ore treated decreased by 45% to 14.5 Mt with an average grade of 0.65% copper that yielded 225,300 t of copper concentrates, which contained 74,466 t of copper. The copper concentrate grade was 32.6%. The Palabora smelter produced 85,517 t of copper anodes, which was down 6% from 2000; the refinery output declined to 86,904 t of copper cathodes from 87,683 t in 2000. Palabora also produced a variety of other products from the unique carbonatite mineralogy of its deposit, which included 166,078 t of 90.52% vermiculite concentrates, 139,214 t of sulfuric acid, 41,585 kg uranium oxide, 9,518 kg of precious metals contained in refinery tankhouse slimes, 7,897 t of zirconium dioxide chemicals, and 264 t of nickel sulfate. The Palabora Mine also generated 201,000 t of byproduct magnetite concentrates that graded nearly 62% iron and 1.6% titanium dioxide, which were either sold to the coal-washing industry or stockpiled for possible future use in a proposed new hot-briquetted iron facility in Mozambique. Measured mineral resources were reported to be 5.75 Mt of oxide ore that graded 0.6% copper. Three categories of proved and probable mineral reserves were given—for the open pit, 4.65 Mt at 0.69% copper; for the underground, of 242 Mt at 0.68% copper; and of sulfide ore, 40 Mt at 0.14% copper (Palabora Mining Company Limited, 2002, p. 60-63).

O'okiep Copper Co. (Pty.) Ltd., which was owned by Metorex, operated a copper mine at Nigramoep and a copper smelter at Nababeep, in the Northern Cape Province. For the fiscal year that ended June 30, 2002, O'okiep milled 67,000 t/mo of ore at an average head grade of 1.79% copper. With a 95% smelter recovery rate, blister copper production was 13,000 t/yr. Mining operations at Nigramoep were to be phased out during 2002. A new $7 million concentrator, however, was being built at Nababeep to retreat the slag dump, which contained about 7 years of reserves estimated to be 4.4 Mt at a grade of 1.5% copper, and to treat copper concentrates imported from Metorex's Chibuluma operation in Zambia. This project should be complete early in 2002 and was expected to run for 7 years (Metorex Ltd., 2002b).

Copper was also produced in small amounts as a byproduct of lead-zinc and platinum mining.

Gold.—After more than 30 years of progressive decline in gold production from the historical peak production of 989 t in 1970 to 395 t of gold in 2001, gold production in South Africa appeared ready for a reversal of this trend. With three new large gold mine projects, which will represent a combined capital investment of more than $1.6 billion, coming onstream during 2002 and 2003, gold production was expected to reach 450 t by 2003 and close to 480 t by 2007. Anglovaal Minerals Ltd.'s gold subsidiary Avgold Ltd. expected to start production of its Target Mine in 2002 at a rate of 4,900 kilograms per year (kg/yr) of gold and will increas to full production of 15,500 kg/yr of gold by 2007. The South Deep Mine (a 50-50 joint venture between Western Areas Ltd. and Placer Dome, Inc. of Canada) was producing at one-half capacity rate of 12,500 kg/yr in 2001 and will ramp up to full production of 23,300 kg/yr by 2007. The third major project, AngloGold's Moab Khotsong Mine, will start production in 2003 at a rate of 12,000 kg/yr of gold and will increas to 16,600 kg/yr of gold by 2007.

During 2001, member companies of the South African Chamber of Mines, which represented 89% of gold production, milled 83 Mt of ore at an average grade of 4.13 g/t gold, which

Digitized by Google

yielded 342,551 kg of gold. The industry employed 201,700 people in 2001, down from 216,200 people in 2000. Despite an 8% decline in gold production between 2000 and 2001 and a 3% drop in the average annual gold price to $272 per ounce of gold from $280 per ounce, the value of gold sales in rand terms increased to R29 billion in 2001 from R25.3 billion in 2000. The devalued rand permitted the South African gold industry to absorb rand-denominated production costs and to maintain its international competitive position despite the lower dollar price for gold exports. Gold production was concentrated within the four major companies—AngloGold with 37.5%; Gold Fields Ltd., 26.2%; Harmony, 19% and Durban Roodeport Deep Inc., 8.4%. Harmony Gold Mining, which has developed into a major gold mining company since it was spun off from Randgold Resources Ltd. in 1997 to operate and turn around small, high-cost marginal gold operations, had the largest increase in production. Since 1995, through an aggressive policy of acquisitions that cost more than $450 million, Harmony has increased its gold production to 77,760 kg/yr from 18,000 kg/yr, and has increased its gold reserve base to more than 1,026 t (33 million ounces) from nearly 249 t (8 million ounces) since 1996. The reserve base estimates were based on a gold price of $262 per troy ounce (Harmony Gold Mining Co. Ltd., 2001, 2002b§).

Encouraged by the Government's black economic empowerment policy, the gold industry saw increased participation of African companies during 2001. In January 2002, the Free Gold Joint Venture was set up between Harmony and the black empowerment company African Rainbow Mines Ltd. (ARMgold) based on the $157 million acquisition of the Free State operations of AngloGold (Harmony Gold Mining Co. Ltd., 2002a). In February 2002, Khumo Bathong Holdings acquired a 3% interest in Durban Roodepoort Deep Inc. and a 60% interest in its Crown Section tailings retreatment plant.

Iron and Steel.—*Iron Ore.*—In November, Iscor Ltd. completed its unbundling of assets and retained its iron and steel operations and spun off all of its iron ore, coal, base-metals titanium, and industrial minerals mining operations into a new company Kumba Resources Ltd. Iscor retained a 75% interest in Kumba; the Industrial Development Corporation of South Africa took 23.5%. The new companies began operating on January 1, 2002 (Kumba Resources Ltd., 2001§). In March 2002, Anglo American acquired a 20% interest in Kumba. In 2001, iron ore production in South Africa increased to 34.76 Mt, gross weight containing about 22.4 Mt of iron, or about 3% more than that of 2000. Of total sales of iron ore in 2001 of 34.88 Mt valued at about $480 million, 67% was exported, and 33% was shipped to domestic steel plants. Iscor was South Africa's largest iron ore producer in 2001. Its two iron mines, Sishen and Thabazimbi, on a contained iron basis, accounted for about 75% of the country's total output—the Sishen Mine in Northern Cape Province, 23.81 million metric tons per year (Mt/yr) of contained iron ore that graded 65% iron, and the Thabazimbi Mine in Northern Province, 2.17 Mt/yr of contained iron ore that graded about 60% iron. Thabazimbi is a captive mine that supplied lump and fine iron ore to Iscor steel plants at Vanderbijlpark outside of Johannesburg and at Newcastle in northern KwaZulu-Natal; 80% of the iron ore production at Sishen was railed to Saldanha Bay for export. The expansion of the Sishen Mine to 27 Mt/yr was completed in March 2002. The ongoing $100 million expansion program will increase the mine's production capacity to 30 Mt/yr of iron ore by 2003 and to 38 Mt/yr of iron ore by 2007. Concurrent with the expansion of the operation, the rail and port infrastructure associated with the Sishen-Saldanha exports will also be upgraded. Thabazimbi had a remaining mine life of between 6 and 8 years, and a prefeasibility study to replace this production by developing the Welgevonden deposit, which is located some 60 kilometers (km) south of Sishen and contains a high-quality resource of 259 Mt of iron ore suitable for open pit mining, is being conducted (Iscor Ltd., 2002a§).

For the financial year that ended June 30, 2002, Assmang Ltd. produced 4.77 Mt of iron ore from its operations at the Beeshoek Mine. A new $11 million iron ore jig plant was also commissioned during the year (Assmang Ltd., 2002b§).

Iron and Steel.—In 2001, South African crude steel production increased by 4% to 8.82 Mt and stainless steel production by 1% to 440,000 t. Iscor, which was the main producer, accounted for 6.45 Mt/yr of steel products, of which 46% is exported, for its financial year ended June 30, 2002. Iscor steel operations are set up into two business units. Its flat steel products division operated the Saldanha Bay steel plant and the steel plant at Vanderbijlpark, which produced 3.51 Mt/yr of steel in the financial year ended June 30, 2002, and represented 84% of the domestic market and 70% of Iscor's total steel volume. The Saldanha Steel (Pty.) Ltd. steel plant at Vredenburg near Saldanha Bay had the capacity to produce 1.25 Mt/yr of hot-rolled coil steel and was the world's first steel minimill to combine the Corex and Midrex technologies (replacing blast furnace technology) and to be designed as an environmentally clean facility. The company has suffered through continually depressed world steel markets and prices and some startup design deficiencies and as a result, Saldanha Steel had R1.5 billion in losses between July 2000 and June 2002. Originally a joint venture between Iscor (50%) and Industrieal Development Corporation (IDC) (50%), Iscor bought out IDC's share in November in an effort to rationalize operating efficiencies at Saldanha Steel with its other operations. Iscor will shift production of all thin-gauged steel products to Saldanha, which will free up 120,000 t of capacity at the Vanderbijlpark Works for other markets. For the financial year ending June 30, 2002, Saldanha Steel reported that production declined by 1% to 933,000 t of steel. Relining of the refractories in the Corex furnace was expected to allow Saldanha to produce closer to its design capacity in 2003. Iscor's long steel products division operated the integrated steel works at Newcastle in Kwa-Zulu Natal Province, and the electric-arc-furnace-based steelworks at Vereeniging in Gauteng Province; together they accounted for total sales of 2.01 Mt/yr of steel, 36% of which was exported (Iscor Ltd., 2002b§).

In August, South African steel producers received an unfavorable ruling from the U.S. International Trade Commission (USITC) under section 201 of the U.S. Fair Trade Act of 1974. The ruling claimed that imports of hot-rolled steel products from Argentina and South Africa had been sold in the United States at less than fair market value. Under the ruling, duties would be imposed on South African hot-rolled steel imports into the United States for at least 5 years (Steel News, 2001§). The ruling was subject to appeal by South Africa, and in May 2003, the USITC

Digitized by Google

overturned its ruling by stating that South Africa had acted responsibly in their trade relations with other countries. The ruling ended USITC investigations into South Africa by stating that the U.S. steel industry was not injured or threatened by material injury by South African imports (Steel News, 2002§).

Effective January 2002, Acerinox, SA (Spain), acquired a 64% controlling interest in Columbus Stainless (Pty.) Ltd. for $230 million; Highveld Steel and Vanadium Corp. Ltd., IDC, and BHP Billiton plc (Samancor) retained 12% each. Acerinox's steel production experience could turn around the technical and economic problems that Columbus has faced since it opened. Highveld announced that it took a $56 million loss on the sale. Columbus had a production capacity of between 500,000 and 600,000 t/yr of cold-rolled slab, plate, sheet, and coil depending on the product mix. For 2001, Columbus produced 439,300 t of slab steel, which was an 8% decrease compared with that of 2000, and salable production amounted to 433,907 t, which was a 15% increase compared with that of 1999. About 75% of production was exported. Highveld produced 935,760 t of carbon steel in 2001 compared with 947,588 t in 2000 from its plant at Witbank, Mpumalanga Province. Highveld's in-house production of crude carbon steel dropped by 1% to 935,760 t in 2001 (Fraser, 2001, 2002; Highveld Steel and Vanadium Corp. Ltd., 2002§).

Lead and Zinc.—During 2001, Anglo American produced 45,800 t of lead and 24,300 t of zinc compared with 68,100 t of lead and 27,100 t of zinc in 2000 from its Black Mountain Mine near Aggeneys, Northern Cape Province; the mine also produced about 10,000 t/yr of copper. Ore reserves at Black Mountain were recalculated for yearend 2001 at a 56% higher tonnage and lower average grades as 12.7 Mt at a grade of 0.54% copper, 3.05% lead, and 1.78% zinc plus measured and indicated mineral resources estimated to be 3.2 Mt at a grade of 0.54% copper, 2.8% lead, and 1.01% zinc. Black Mountain has a remaining mine life of 13 years (Anglo American plc, 2002§).

In May 2000, Anglo American announced plans to invest $110 million in Black Mountain. The major element of the expansion project, which was scheduled for completion in 2004, will be the sinking and equipping of a new vertical shaft from surface to a depth of 1,750 meters (m) together with associated underground development. The life of the mine will be extended to at least 2013 (Anglo American plc, 2000§).

Maranda Mining Co. (Pty.) Ltd. (owned by Metorex) operated the Maranda zinc-copper mine in the southwestern portion of the Murchison Greenstone Belt in Northern Province. For the fiscal year that ended June 30, 2002, Maranda milled at rate of 7,600 t/mo of ore at a head grade of 1.8% copper and 15.1% zinc. Production for the year of metal contained in concentrates was reported at 5,888 t of copper and 13,308 t of zinc. On June 30, 2002, proved and probable reserves were estimated to be 0.2 Mt at a grade of 15.4% zinc and 1.5% copper, and mineral resources, exclusive of reserves, totaled 0.48 Mt at a grade of 20.5% zinc and 1.6% copper (Metorex Ltd., 2002c§).

BHP Billiton plc's Pering zinc-lead mine was scheduled for closure in late 2002.

Manganese and Ferromanganese.—South Africa dominated the world manganese market as the largest producer of manganese with approximately 80% of the world's reserve base of manganese ore. In 2001, production declined to 3.26 Mt gross weight of manganese ore and concentrates compared with 3.63 Mt in 2000; these were primarily metallurgical grades that ranged from 30% to more than 48% manganese. For the financial year that ended June 30, 2002, Samancor's Manganese Division produced 1.87 Mt of ore from its Mamatwan open pit and Wessels underground mines near Hotazel, which was a decline of 14% from the previous year, and 406,000 t of manganese alloys. Proved and probable mineral reserves were reported to be 37.25 Mt at a grade of 38% manganese at the Mamatwan Mine and 17.3 Mt at a grade of 48.3% manganese at the Wessels Mine. About 40% of Samancor's manganese ore production was exported to ferroalloy producers worldwide. The remainder was converted into alloys at Samancor's Manganese Division works at Meyerton, Gauteng Province and into manganese metal by the Manganese Metal Co. Pty. Ltd. The Manganese Division, in turn, exported 85% of its production (BHP Billiton plc, 2002b§).

Assmang operated the Gloria and Nchwaning underground manganese mines in Northern Cape Province. Assmang was investing $75 million to add a new 2,200-m deep shaft complex at the Nchwaning III Mine, which was expected to be operational by late 2003. The expanded Nchwaning operation will have a run-of-mine capacity of about 2 Mt/yr of manganese, which could extend its mine life by more than 20 years. For its financial year that ended June 30, 2002, Assmang sales included 993,000 t of manganese ore compared with 979,000 Mt in 1999 and 187,000 t of manganese alloys compared with 193,000 t in 1999. Ferromanganese production comes from Assmang plants at Cato Ridge near Durban and Machadadorp near Middleburg. Also during the year, Assmang dissolved Ferroalloys Ltd. (its subsidiary company) and brought its Cato Ridge ferromanganese plant in-house (Assmang Ltd., 2002a§).

Highveld produced 154,159 t of medium carbon manganese and silicomanganese alloys in 2001 compared with 157,143 t in 2000 from its Transalloys Division at Witbank (Highveld Steel and Vanadium Corp. Ltd., 2002§, p. 3).

Nickel.—South Africa's nickel production was in the form of metal, metal-in-concentrate, and sulfate. About 88% of nickel production came as a byproduct of PGM processing, nearly 250 t as nickel sulphate from the Palabora copper mine, and the remainder as primary production from the Nkomati nickel mine. In 2001, production held near constant at 36,400 t. Domestic sales of nickel, primarily to the stainless steel plants, amounted to about $128.2 million, and export sales of nickel were valued at more than $82.2 million. Nickel production is expected to expand significantly between 2000 and 2007 as the platinum industry undergoes a 67% expansion and if the Nkomati Joint Venture proceeds with its proposed expansion. A proportional increase in byproduct nickel production from the expansion of the PGM industry was not expected; much of the new platinum production, however, will come from the UG2 chromititic seams, which have a lower nickel content than the other reefs currently being mined for PGMs.

During 2001, the Nkomati Joint Venture [controlled by Avmin (75%)] milled 289,000 t of ore that produced 42,000 t of concentrate with an average nickel grade of 10.47%. This

Digitized by Google

resulted in final metal production levels of 4,000 t of nickel and economically important byproduct production of copper (2,500 t), cobalt (54 t), and PGM (1,014 kg). Nkomati was expected to complete a feasibility study to assess the potential of completing the mining of the high-grade MSB ore body and to begin the underground and surface development of the lower grade MMZ ore body in early 2002. The proposed $200 million project would increased production to 17,500 t/yr of nickel, 9,000 t of copper, 800 t of cobalt, and 2,488 kg of PGM (Anglovaal Mining Ltd. 2002§).

Platinum-Group Metals.—Surpassing gold in 2001 as the most important export commodity by value, PGM production in South Africa increased by 11% to 229,913 kg with exports of 193,354 kg valued at $3.9 billion. Production by individual commodity included 129,746 kg of platinum, 62,142 kg of palladium, 19,329 kg of ruthenium, and 13,453 kg of rhodium. The PGM industry employed nearly 100,000 workers in 2000.

A U.S. Geological Survey analysis of industry investment plans shows that between 2000 and 2007, more than $3.5 billion was projected to be spent in South Africa on adding 98,600 kg (3.17 million ounces) in new capacity, which will bring total PGM production capacity to 246,300 kg (7.92 million ounces). This included $2 billion by Anglo American Platinum Corp. Ltd. (Anglo Platinum), which was the largest PGM producer in the world at about 37% of global platinum supply, to expand capacity by 75% to 108,860 kg/yr of PGM; $780 million by Impala Platinum Holdings Limited (Implats), which was the second largest producer in South Africa, to expand capacity by 34% to 76,510 kg/yr; $550 million by Lonmin plc to expand capacity by 45% to 27,060 kg/yr; $64 million by Northam Platinum Ltd., which is now majority controlled by the black empowerment company Mvelaphanda Platinum Ltd. to increase capacity by 31% to 13,060 kg/yr; and several greenfield developments by Aquarius Platinum Ltd. of Australia, SouthernEra Resources Ltd. of Canada, and Two Rivers Platinum (Pty.) Ltd. that will add another 19,000 to 20,000 kg/yr by 2007. Other black empowerment companies that participated as joint-venture or minority-interest partners in the expansion of the PGM sector included African Rainbow Minerals on the Twickenham (Maandagshoek) project; the Royal Bafokeng Nation on the Bafokeng Rasimone platinum mine project; TISO Capital (Pty.) Ltd. on the Dwarsrivier Farm Project; and the Bapo Ba Mogale tribe on the proposed Pandora Project.

Titanium and Zirconium.—Globally, South Africa ranked second in titanium production and third in titanium exports in 2000. Richards Bay Minerals (owned jointly by Rio Tinto and BHP Billiton) produced ilmenite, rutile, and zircon from beach sands north of Richards Bay. Richards Bay Minerals was the trading name for two registered companies—Richards Bay Iron and Titanium (Pty.) Ltd. (RBIT) and Tisand (Pty.) Ltd. Tisand was responsible for the dune mining operation and mineral separation. RBIT, which was responsible for the smelting and beneficiation process, produced an 85% titanium dioxide slag from ilmenite concentrates at the Richards Bay smelter as well as low-manganese pig iron. The flowsheet for the operation was available on the company Web site accessible at URL http://www.richardsbayminerals.co.za. The Richards Bay operation was the largest titanium mineral producer in the country and held the rights to more than 1 billion metric tons of heavy-mineral sands reserves, which would be sufficient to maintain mining for approximately 20 more years. Production for calendar year 2001 was estimated to be 875,000 t of titanium slag, 210 t of zircon, and 90 t of rutile (BHP Billiton plc, 2002b, p. 75-76).

Namakwa Sands Limited operated a heavy-mineral sand mine at Brand-se-Baai and a mineral separation plant at Koekenapp, which is located 340 km northwest of Cape Town, and a smelter at Vredenburg, which is near the export harbor at Saldanha Bay. Production of titanium slag decreased by 5% in 2001 to 104,600 t of titanium chloride slag. In addition, 114,100 t of zircon, 84,400 t of pig iron, 28,200 t of titanium sulfate slag, and 27,100 t of rutile were produced as byproducts of titaniferous production. Remaining resources at Namakwa Sands at yearend 2001 were 539 Mt at a grade of 3.5% ilmenite, 0.9% zircon, and 0.2% rutile (Anglo American plc, 2002§).

The $275 million Ticor Heavy Minerals Project [a joint venture between Kumba Resources (60%) and Ticor Ltd. of Australia (40%)] was officially opened in September, although full capacity was not expected to be reached until 2002. Kumba also held a controlling 50.12% interest in Ticor, which gave it an effective 80% control of the project. The mine and plants are located near the Richards Bay deep-sea port in KwaZulu-Natal Province and were expected to be at full capacity by 2005. The project is being developed in the following phases:

- Phase 1—Establishment of the Hillendale Mine and Mineral Separation Plant,
- Phase 2—Commissioning of the smelter's first furnace at Empangeni by 2003, and
- Phase 3—Establishment of the second mine at Fairbreeze and commissioning the smelter's second furnace by 2005.

The project design called for production of 550,000 t/yr of ilmenite, 250,000 t/yr of titanium slag, 145,000 t/yr of pig iron, 100,000 t/yr of zircon, and 40,000 t/yr of rutile by 2005. To assist with cashflow, Kumba was selling a portion of the startup mine production. For its financial year that ended June 30, 2002, the Ticor Heavy Mineral Project produced 686 t of heavy-mineral concentrate, 471 t of ilmenite, 45 t of zircon, and 19 t of rutile (Kumba Resources Ltd., 2002§).

Titaniferous magnetite also was recovered at the Phalaborwa carbonatite as a byproduct of copper and phosphate rock production. Titaniferous slag was produced from Mapoch Mine magnetite ores at Highveld's Witbank steel plant.

Zirconium was produced as a zircon byproduct of mining at the Richards Bay Minerals and the Namakwa Sands mineral sands operations. During 2001, Palabora Mining Co. Ltd. permanently closed its Heavy Minerals plant which produced zirconium dioxide and calcined uranium oxide. The August 2001 closure was attributed to depleted feedstocks of baddeleyite ore from the open pit. Palabora concentrated its efforts at upgrading its new zirconium basic sulfate (ZBS) plant to make more value-added zirconia products. During 2001, Palabora produced 30.6 t of uranium oxide and 1,574 t of zirconium concentrate. The ZBS plant was to be commissioned in early 2002 (Palabora Mining Company Limited, 2002).

With the decline in availability of natural zircon-bearing baddeleyite, a new South African company, Geratech Zirconium Beneficiation Ltd., has been developing a process to separate silica from zirconium in zircon sands to permit its use in making

Digitized by Google

zirconium chemicals. With investment assistance from Sasol Technology and the South African Department of Arts, Culture, Science and Technology, a pilot plant at the Nuclear Energy Corp. facility in Pelindaba was upgraded to a capacity of 80 t/mo in 2001 to allow the commercial production of acid zirconium sulfate tetrahydrite (AZST). During 2001, investors were being sought to construct a larger commercial AZST plant (Geratech Zirconium Beneficiation Ltd., 2001§).

Vanadium and Ferrovanadium.—South Africa was the world's largest producer and exporter of vanadium. Vanadium was produced from titaniferous magnetite mined from the Bushveld Complex. The largest producer was Highveld. In 2000 and 2001, Highveld's production of vanadium slag increased by 5% to 73,666 t; ferrosilicon decreased by 3% to 54,159 t (Highveld Steel and Vanadium Corp. Ltd., 2002, p. 3).

Xstrata was the second largest South African producer of vanadium through its holdings in Rhombus Vanadium Holdings Ltd. and Vanadium Technology (Pty.) Ltd. In 2001, despite vanadium demand being tied to weak steel markets, Xstrata benefitted from marketing contracts with Glencore and increased production of vanadium pentoxide by 37% to 17,646 t and ferrovanadium by 500% to 6,118 t. The large increase in ferrovanadium production reflected Xstrata policy to produce more value-added products within South Africa (Xstrata AG, 2002 b§).

In another trade and antidumping conflict between South Africa and the United States, the U.S. Ferroalloys Association Vanadium Committee filed a petition with the U.S. Department of Commerce, International Trade Administration, in November, charging Xstrata Alloys and Highveld with dumping ferrovanadium products into U.S. markets at less than fair value. A January 2002 preliminary determination by the U.S. International Trade Commission and a July 2002 preliminary ruling by the International Trade Administration established "material injury" to the U.S. ferrovanadium industry and levied an antidumping duty on ferrovanadium sales into the United States of 37.29% on Xstrata and 45.58% on Highveld (U.S. Department of Commerce, 2002§; U.S. International Trade Commission, 2002§).

Industrial Minerals

South Africa produced about 30 different industrial minerals from more than 500 mines and quarries, about one-half of which were devoted to aggregate and sand production. The industrial minerals sector employed more than 14,000 workers and was a significant contributor to total mineral sales. In 2001, the value of total sales of industrial minerals produced decreased by more than 11% in dollar terms to $529.6 million compared with $602 million in 2000. Approximately 68% of those sales was on the domestic market. In terms of sales, the three dominant industrial mineral commodities were aggregate and sand, limestone and dolomite, and phosphate rock. The largest domestic consumers of South Africa's industrial minerals were the building and construction, metallurgical, and agricultural sectors. Total export earnings for industrial minerals were nearly $172 million in 2001. Granite and norite dimension stone accounted for 47% of industrial mineral exports; the other major export commodities were, by value, vermiculite, phosphate rock, andalusite, and asbestos. South Africa accounted for 40% of the world's supply of vermiculite, 37% of andalusite, and more than 6% of fluorspar and granite (South Africa Department of Minerals and Energy, 2002, p. 127-137).

Cement.—Domestic cement production increased by 2% to 9.17 Mt in 2001, but still substantially less than the 9.8 Mt of 1997. Domestic sales of cement totaled 8.04 Mt in 2001. The major consuming Provinces were Gauteng (35.8.3%), Kwa-Zulu Natal (14.8%), Western Cape (11.9%), and Northern (now known as Limpopo) (9.9%). Export sales of cement to the neighboring countries of Botswana, Lesotho, Namibia, and Swaziland increased by 3.7% to 1.13 Mt in 2001 (Cement and Concrete Institute of South Africa, 2002§). Following a buildup in capacity during the 1980s, demand has declined, and the industry, in recent years, has been operating at about 60% of capacity. The structure of the cement industry and current ownership is noted in table 2.

Diamond.—Rough diamond production increased by 3% in 2001 to 11.17 million carats. As in years past, mines owned by De Beers dominated the sector with more than 90% of the total production. Total diamond production for De Beers' South African operations in 2000 amounted to 10.29 million carats recovered from 23.3 Mt of material treated. The Venetia Mine, which was the largest De Beers operation, recovered 4,497,756 carats with a revenue per carat of $55; the Finsch Mine, 1,925,059 carats at $50 per carat; the Premier Mine, 1,782,420 carats at $46 per carat; the Namaqualand Mine, 809,928 carats at $159 per carat; the Kimberley Mine, 568,639 carats at $76 per carat; the Marsfontein Mine, 436,191 carats at $165 per carat; the Koffiefontein Mine, 151,498 at $228 per carat, and The Oaks Mine, 116,048 carats at $165 per carat. Recovered diamond grades varied considerably within the De Beers operations during 2000—with 122 carats per 100 t recovered at Venetia, 82.2 carats per 100 t at Marsfontein, 62.6 carats per 100 t at Premier, 54.7 carats per 100 t at The Oaks, 45.8 carats per 100 t at Finsch, 16.2 carats per 100 t at Kimberley, 13.2 carats per 100 t at Namaqualand, and 6.9 carats per 100 t at Koffiefontein (De Beers Group, 2002a§). In May, De Beers announced plans to investigate development of the "Centenary Cut" at its Premier Mine. If approved, then the estimated $660 million project would more than double production at Premier to 9 Mt/yr of ore from its current capacity of 4 Mt/yr. A mechanized block caving mining method would be used to extend the depth of the mine from the 730-m level to the 1,100-m level. An investment decision was expected in 2003 (De Beers Group, 2002b§)-

For the financial year that ended June 30, 2002, TransHex International produced 221,486 carats from its operations in northwest South Africa. Seven land operations, the largest of which was located at Baken, accounted for 176,642 carats of output with values that ranged from $92 per carat to $931 per carat. Production from three shallow water and two deepwater operations amounted to 44, 844 carats that ranged from $137 per carat to $358 per carat (Trans Hex Group, 2002§).

During 2000, SouthernEra Resources Ltd. of Canada announced plans to develop its third diamond mine the

Digitized by Google

Klipspringer in Limpopo Province east of the towns of Potgietersrus and Pietersburg; completion was expected by 2003. The underground development will produce 160,000 carats per year at capital cost of $7 million. On the basis of a minable reserve of 3.6 Mt at an average recovered grade of 47 carats per 100 t, valued at $100 per carat, the Klipspringer project will have a mine life of more than 13 years. Ore will be treated at SouthernEra's existing dense-medium separation plant at Klipspringer. In April 2001, the Klipspringer Joint Venture (KJV) was established among SouthernEra (50%), De Beers and Steppon Investments (Pty.) Ltd. (a jointly owned Black Economic Empowerment company with De Beers). The KJV replaced the Marsfontein Joint Venture, which effectively extended the original joint venture with De Beers over a larger area of ground, which included the Marsfontein and Klipspringer diamond mines. During 2001, SouthernEra recovered 84,715 carats, valued at $3.8 million from the nearly depleted Marsfontein Mine and from underground predevelopment work at Klipspringer (SouthernEra Resources Ltd., 2000§, 2002§).

Increasing international concern about the growing evidence of illegally mined and exported diamond revenues being used to support civil conflicts in Angola, Sierra Leone, and elsewhere led to the holding of the first United Nations-sponsored Kimberley process ministerial meeting in Botswana in November. Attended by 35 countries involved with the mining of, cutting of, or trading in rough diamond, the Kimberley process aimed to establish a system of certificates of origin to control the global trade in diamond. The meeting brought together most of the major stakeholders, which included governments; the diamond mining, processing, and trading industry; and concerned nongovernmental organizations, such as Global Witness from London, United Kingdom, whose research, along with several United Nations Security Council Panel of Experts reports, added considerable transparency to the issue. The extensive findings of these groups can be viewed at their respective Web sites at http://www.un.org/Docs/sc/committees/Angola/AngolaSpecEng.htm; http://www.un.org/Docs/sc/committees/SierraLeone; http://www.kimberleyprocess.com; and http://www.globalwitness.org/campaigns/diamonds/index.php.

Fluorspar.—In 2001, production of 286,400 t of fluorspar was distributed among Vergenoeg Mining Company (Pty.) Ltd. (owned by Metorex), Witkop Fluorspar Mine (Pty.) Ltd. [owned by the Australian company South Africa Land & Exploration Company (Sallies)], and Buffalo Fluorspar Mine, which was reopened by International Metal Processing of South Africa in 2000.

The open pit Vergenoeg Mine, which is located 70 km north-northwest of Pretoria, milled 51,000 t/mo of ore at a head grade of 38% calcium fluoride. Production was 15,363 t/yr of metallurgical-grade fluorspar and 111,489 t/yr of acid-grade fluorspar. As of June 30, 2002, mineral reserves were reported to be 4.5 Mt at grade of 36.8% calcium fluoride (CaF_2) plus mineral resources of 217.5 Mt that graded 23.4% CaF_2 (Metorex Ltd., 2002d§).

The capacity of the Witkop operation from four quarries and a flotation plant was 140,000 t/yr of acid-grade fluorspar. During 2001, the company was studying the feasibility for doubling capacity to 240,000 t/yr of fluorspar.

Vermiculite.—The major producer was the Vermiculite Operations Division of Palabora, which extracted vermiculite from the pyroxenite units of the mineralogically diverse Phalaborwa Carbonatite Complex. In 2001, vermiculite concentrate production decreased by 20% to 166,078 t. The production decrease was attributed to heavy rainfalls during the year and led to a decision to build a covered roof over the stockpiles by early 2002. The company has been updating its vermiculite resource estimates and at yearend 2001 reported 99.2 Mt of measured, indicated, and inferred resources at an average grade of 28% vermiculite, of which proved and probable reserves were 45.7 Mt at an average grade of 32.1% vermiculite. Common to other industrial minerals, approximately 70% of Palabora's delivered costs of vermiculite to markets in Asia and Europe were in logistics and transport (Palabora Mining Co. Ltd., 2002, p. 16-17).

Mineral Fuels

Coal.—Following platinum and gold, coal was one of the most important sectors of the mineral economy of South Africa. During 2001, 55 coal mines employed more than 48,000 workers. South Africa remained the fifth largest coal-producing country in the world and the third largest coal exporter. In 2001, production held level at 223.5 Mt of salable coal valued at $3.1 billion; of this total, 69.2 Mt valued at $1.98 billion was exported primarily through the Richards Bay Coal Terminal (RBCT). The RBCT had a steam coal exporting capacity of 72 Mt/yr with plans to expand the capacity to 81 Mt/yr by 2007. Export destinations for South African coal were, in order of importance, Europe, Asia and the Middle East, Africa, and South America. More than 88% of salable coal production was controlled by Ingwe Coal Corp. Ltd. (29%), Anglo American Coal Corp. Ltd. (21%), Sasol Mining (Pty.) Ltd, (9%), Eyesizwe Coal (Pty.) Ltd. (9%), and Kumba Resources (8%). In 2001, 152.2 Mt of coal was consumed domestically. The majority of domestic sales went to electricity (89 Mt), synthetic fuels production (48 Mt), and industry (6 Mt). A reassessment of South Africa's coal reserves by the DME was expected by the end of 2003 (South Africa Department of Minerals and Energy, 2002, p. 52-53).

In February 2002, Xstrata proposed acquiring all the Australian and South African coal assets of Glencore, which included the assets of Duiker Mining Ltd. in South Africa, for $2.5 billion. In 2001, Duiker produced 17.7 Mt of coal from 13 mines, which included its 16% minority share of joint-venture operations with Ingwe. At yearend 2001, Duiker coal reserves were estimated to be proven and probable reserves of 637 Mt, measured and indicated resources of 6.64 billion metric tons (Gt), and inferred resources of 3.6 Gt (Xstrata AG, 2002a§).

Petroleum and Natural Gas.—Soekor controlled all offshore oil and gas prospects. In 2001, the country produced only 4.2% of its crude oil requirements. Crude oil production offshore from Mossel Bay was limited to 15,000 barrels per day (bbl/d) from the Oribi Field and 10,000 bbl/d from the Oryx Field. Soekor discovered oil and gas in five wells drilled in the Sable Field; field development studies suggested the potential to produce 40,000 bbl/d from the field. Soekor was seeking to

Digitized by Google

lease the Sable Field to a major contractor, which would supply a new floating production and storage and offloading (FPSO) vessel and operate the oilfield (Soekor E & P (Pty.) Ltd., 2001§).

As an outgrowth of the 1998 White Paper on Energy Policy, in January 2002, the Government established the Petroleum, Oil and Gas Corporation of South Africa (PetroSA), which was formed from a merger of three parastatal companies—Mossgass Pty. Ltd., which was a maker of synthetic fuels; Soekoer E & P (Pty.) Ltd., which was an oil and gas exploration company; and sections of the Strategic Fuel Fund, which was a trading and fuel storage agency. PetroSA's mission will be as an active player in global oil and gas exploration and production and in the production and marketing of petrochemicals. Details are available at the new company's Web site at http://www.petrosa.com.

Mossgas, which used natural gas to produce synthetic motor fuel at its plant at Mossel Bay, produced natural gas from several offshore fields under mining leases from Soekor. The F-A Field, which was discovered by Soekor in 1984 and is located 85 km south of the town of Mossel Bay, was producing at an average rate of 5.49 million cubic meters per day of natural gas and 9,500 bbl/d of condensate. The E-M gasfield, which is located 50 km west of F-A, was commissioned by Mossgas in September 2000. Combined with several other smaller fields in the area, gas resources were sufficient to supply Mossgas until 2008. Separate 91-km pipelines convey gas and condensate to the Mossgas synfuels plant where petrol, diesel, and kerosene were produced at a rate of 36,000 bbl/d of finished product (Soekor E & P (Pty.) Ltd., 2001§).

Synthetic Fuels.—South Africa had a highly developed synthetic fuels industry that took advantage of the country's abundant coal resources and offshore natural gas and condensate in Mossel Bay. The two major players were Sasol (coal-to-oil/chemicals), which was the world's largest manufacturer of oil from coal, and Mossgas (natural-gas-to-petroleum products). Sasol had the capacity to produce 150,000 bbl/d, and Mossgas, 45,000 bbl/d. Sasol's coal liquefaction plants were located at Secunda (oil) and Sasolburg (petrochemicals). Started by the Government in the 1950s to help reduce South Africa's dependence on imported oil, the company was privatized in 1979. In the coal liquefaction plants, coal is first gasified, and then turned into a range of liquid fuels and petrochemical feedstocks. Further details on South Africa's energy and fuels industries, which included Sasol's efforts to use imported natural gas from Mozambique and possibly Namibia to replace coal as the feedstock for its conversion process, are available at the U.S. Energy Information Administration (2002§) Web site.

Reserves

South Africa's mineral reserves are large and varied and reflect the country's complex geology. A detailed description of the geology and mineral resources of South Africa was updated by the Council for Geosciences in 1998 (Wilson and Anhaeusser, 1998). The bulk of South Africa's mineral production is from the northern half of the country. Table 3 lists the reserve base for a number of South Africa's major minerals. Although data for many of the minerals listed are incomplete for the world, South Africa's reserves appear to rank among the top five countries and would rank first in the world for andalusite, chromite, gold, manganese, PGM, and vanadium.

Infrastructure

The country has a well-developed and extensive road and railroad infrastructure that served not only South Africa, but also the surrounding region. Roadways totaled 358,600 km, of which 17% was paved. Railroad infrastructure totaled 20,400 km, of which 9,090 km was electrified. Portnet maintained the largest and most efficient commodity export harbors in Sub-Saharan Africa, most of which handled minerals, notably Cape Town, Durban, East London, Mossel Bay, Port Elizabeth, Richards Bay, and Saldanha Bay. In addition to fulfilling the requirements of South Africa itself, the country's ports also served as outlets for such landlocked countries as Botswana, Lesotho, Swaziland, Zambia, and Zimbabwe. South Africa was also a regional supplier of electricity and petroleum products, two of a number of examples of the dependence of neighboring countries on South Africa's infrastructure and transportation networks.

Richards Bay handled more than one-half the volume of cargo among South African ports. The RBCT had a coal export capacity of about 72 Mt/yr out of a total bulk cargo port capacity of 75 Mt/yr. A second coal export facility was being built at South Dunes near Richards Bay to handle an additional 12 Mt/yr of coal exports. Coal exports through Durban and the Mozambican Port of Maputo were a fraction of those through the RBCT. Durban's port facilities were designed mainly for small consignments of high-quality lump bituminous coal and anthracite that cannot be handled properly at Richards Bay.

Eskom had a nominal capacity of 41,298 megawatts, predominantly from coal-fired sources, with a small percentage of electricity being generated from nuclear sources, and operated more than 306,100 km of powerlines (Eskom, 2001§). South Africa also maintained 931 km of pipeline for the distribution of crude oil, 1,748 km for petroleum products, and 322 km for natural gas.

Outlook

South Africa is endowed with one of the richest and most diverse concentrations of mineral resources on Earth and has, in terms of size and value, one of the top 10 mining and mineral-processing industries in the world. Contributing more than 25% of the country's GDP, the minerals sector is expected to continue to play an important role in the economy for many years to come. The Government is balancing its need to focus policy initiatives and budget resources on redressing social and economic inequities in the country with its need to maintain economic and labor policies that allow South African exports to remain competitive in global markets. As a sign of confidence in the future of South Africa, domestic and foreign mineral investors have announced plans to commit more than $10 billion to develop or expand new mining and value-added mineral processing capacity between 2000 and 2007. These planned investments are,

Digitized by Google

however, subject to internal and external forces that could delay or constrict actual implementation. Internally, the impact of the high rate of HIV/AIDS in the country on the able-bodied skilled and semiskilled workforce between 15 and 49 and on the resulting increasing direct and indirect labor costs to industry are of concern to investors. Some investment may be reevaluated depending on the outcome of the ongoing debate during 2001 and 2002 on the direction of mineral policy in South Africa, which includes mineral rights, taxation, and local ownership. Externally, the weak global economy is having a negative affect on demand and prices of mineral commodities and is making many projects marginally economic to continue. Increased attention was being given to environmental issues, which are also factors in projects that require financing from international lending institutions. As a result of this weak demand in 2001 and early 2002, evidence indicated that many companies were beginning to rethink the timing of future investments, particularly in ferrous and base-metal projects. These factors will influence the way that the South African Government maintains the investment policies and economic incentives that will determine how South Africa competes for investment with the other major mineral-export-oriented countries, such as Australia and Canada.

References Cited

Fraser, John, 2001, Columbus mill may benefit from 64% sale: Business Day (Johannesburg, South Africa), November 14, 1 p.

Fraser, John, 2002, Highveld blames loss on sale of Columbus: Business Day (Johannesburg, South Africa), February 14, 1 p.

Palabora Mining Company Limited, 2002, Annual report for 2001: Phalaborwa, South Africa, Palabora Mining Company Limited, 67 p.

South Africa Department of Minerals and Energy, 2002, South Africa's minerals industry—2001-2002: Minerals Economics Directorate, December, 202 p.

Wilson, M.G.C., and Anhaeusser, C.R., eds.,1998, The mineral resources of South Africa: Council for Geosciences of South Africa Handbook 16, 740 p.

Internet References Cited

Anglo American plc, 2000 (May 16), Anglo American announces major expansion at Black Mountain Mine, Press Release, accessed October 23, 2001, at URL http://www.angloamerican.co.uk/news_detail.asp?news_item_number=63609.

Anglo American plc, 2002, Reserves and resources, Annual Report for 2001, accessed October 24, 2001, at URL http://www.angloamerican.co.uk/investor/reports.asp#2001ann.

Anglovaal Mining Ltd. 2002, Review of operations—Base metals—Nkomati, Annual Report for 2001, accessed October 23, 2002, at URL http://www.avmin.co.za/annualreport/avmin/2001/basemetals.asp.

Assmang Ltd., 2002a, Group financial results for year ended June 30, 2002, accessed February 9, 2002, at URL http://www.assmang.co.za/financialreports/2002-06-30.asp.

Assmang Ltd., 2002b, Annual report for the financial year ended June 30, 2002, accessed May 12, 2003, at URL http://www.assmang.co.za/investor/financialreports.asp.

BHP Billiton plc, 2002a, Annual report for 2002, accessed March 22, 2003, at URL http://www.bhpbilliton.com/annualReport/plc/html/ downloads.html.

BHP Billiton plc, 2002b, BHP Billiton Limited Group SEC form 20-F/A—Part A—Description of business—BHP Billiton plc, accessed March 22, 2003, at URL http://www.bhpbilliton.com/bb/investorCentre/annualReports.jsp.

Business Day, 2001 (May 29), High Court sanctions buyout of De Beers, accessed October 1, 2001, at URL http://www.bday.co.za/bday/content/direct/1,3523,858608-6078-0,00.html.

Cement and Concrete Institute of South Africa, 2002, Cement and concrete review, Market Review 2001, accessed October 16, 2002, at URL http://www.cnci.org.za/annual_review_2001/market_review.htm.

De Beers Group, 2002a, Production statistics, accessed May 1, 2003, at URL http://www.debeersgroup.com/operations/opsKeyData2001.asp.

De Beers Group, 2002b, Centenary Cut, Premier Mine, South Africa, accessed May 1, 2003, at URL http://www.debeersgroup.com/operations/npCCut.asp.

Eskom, 2001, Key statistics, Annual Report for 2000, accessed October 22, 2001, at URL http://www.eskom.co.za/annreport01/home.htm.

Geratech Zirconium Beneficiation Ltd., 2001, Capital sought for zircon plant, Press Release, accessed February 2, 2003, at URL http://www.geratech.co.za/press.htm.

Harmony Gold Mining Co. Ltd., 2001, Review of operations, Annual Report for 2001, accessed October 22, 2001, at URL http://www.har.co.za/section2/page25.htm.

Harmony Gold Mining Co. Ltd., 2002a (January 7), Acquisition of Free State assets by Harmony and ARM well on track, News Release, accessed February 22, 2003, at URL http://www.harmony.co.za/pressreleases_2002.htm.

Harmony Gold Mining Co. Ltd., 2002b, Operational overview, Annual Report for 2002, accessed February 22, 2003, at URL http://www.harmony.co.za/annualreports.htm.

Highveld Steel and Vanadium Corp. Ltd., 2002, Annual report 2001, accessed October 30, 2002, at URL http://www.highveldsteel.co.za/Financial/Financial_Page.htm.

International Monetary Fund, 2003 (January 23), South Africa—2002 article IV consultation—Staff report; staff statement; public information notice on the executive board discussion; and statement by the Executive Director for South Africa, IMF Country Report No. 03/17, accessed March 31, 2003, at URL http://www.imf.org/external/pubs/cat/longres.cfm?sk=16302.0.

Iscor Ltd., 2002a, Iron ore—Overview, Annual Report 2001, accessed October 22, 2002, at URL http://www.iscor.com/investor_relations/2001/annual2001/index.htm.

Iscor Ltd., 2002b, Annual report for the financial year ended June 30, 2002, accessed February 3, 2003, at URL http://www.iscor.co.za.

Kumba Resources Ltd., 2001 (October 29), Pre-listing statement, accessed February 2002, at URL http://www.kumbaresources.com/Contents/?Cmd=Download&ResourceID=13.

Kumba Resources Ltd., 2002, Review of business operations, Annual Report for Financial Year Ended June 30, 2002, accessed February 9, 2003, at URL http://www.kumbaresources.com/annualreport2002/index.htm.

Metorex Ltd., 2002a, Consolidated Murchison Mines, Operating Companies, accessed December 18, 2002, at URL http://www.metorexgroup.com/ConsMurch.htm.

Metorex Ltd., 2002b, O'okiep Copper Company (Pty.) Ltd., Operating Companies, accessed December 18, 2002, at URL http://www.metorexgroup.com/Ookiep.htm.

Metorex Ltd., 2002c, Maranda Mining Co. (Pty.) Ltd., Operating Companies, accessed December 18, 2002, at URL http://www.metorexgroup.com/Maranda.htm.

Metorex Ltd., 2002d, Vergenoeg, Operating Companies, accessed October 18, 2002, at URL http://www.metorexgroup.com/Vergenoeg.htm.

Soekor E & P (Pty.) Ltd., 2001, Exploration—Oil and gas discoveries, accessed October 16, 2001, at URL http://www.soekor.co.za/explore.htm.

South Africa Chamber of Mines, 2001 (February 28), Industry warns of unintended consequences of new draft mineral development bill, Media Release, accessed June 1, 2001, at URL http://www.bullion.org.za/bulza/release2001/bill.htm.

SouthernEra Resources Ltd., 2000 (August 24), Positive feasibility study completed for Klipspringer diamond project, Press Release, accessed October 24, 2001, at URL http://www.southernera.com/News_Releases/nr000824.htm.

SouthernEra Resources Ltd., 2002, Year 2001 annual report, accessed February 9, 2003, at URL http://www.southernera.com/financials.htm.

Steel News, 2001 (August 20), ITC finds injury from hot rolled steel from Argentina, South Africa, accessed March 17, 2003, at URL http://www.steelnews.com/north_america/2001_target_blanks/Aug01/trade03.htm.

Steel News, 2002 (May 14), ITC votes in South Africa's favor, accessed March 17, 2003, at URL http://www.steelnews.com/world/may02/world_may14.htm.

Trans Hex Group, 2002, Annual report 2002, accessed May 12, 2003, at URL http://www.transhex.co.za/public/financial/financialframes.html.

U.S. Department of Commerce, 2002 (June 26), Preliminary determination in the antidumping duty investigations on imports of ferrovanadium from the People's Republic of China and the Republic of South Africa, International Trade Administration Fact Sheet, accessed March 17, 2003, at URL http://www.ita.doc.gov/media/FactSheet/June02/ferrovanadium_fs_062602.html.

Digitized by Google

U.S. Energy Information Administration, 2002 (September), South Africa, Country Analysis Brief, accessed May 5, 2003, at URL http://www.eia.doe.gov/emeu/cabs/safrica.html.
U.S. International Trade Commission, 2002 (January), Ferrovanadium from China and South Africa—Investigations Nos. 731-TA-986 and 987 (preliminary), Publication No. 3484, accessed March 17, 2003, at URL http://www.usitc.gov/wais/reports/arc/w3484.htm.
Xstrata AG, 2002a (February 21), Proposed acquisition of Australian and South African coal business from Glencore International for an enterprise value of c. USD2.5 billion, Press Release, accessed January 12, 2003, at URL http://www.xstrata.com/press_release.php?id=ac&nb=200202213.en.html.
Xstrata AG, 2002b (March 19), Annual report 2002, accessed January 12, 2003, at URL http://www.xstrata.com/publications.php.

Major Sources of Information

Chamber of Mines of South Africa
P.O. Box 61809
2107 Marshallton, South Africa
Telephone: (27) 11 498-7100
Fax: (27) (11) 834-1884
E-mail: rboers@bullion.org.za
Internet: http://www.bullion.org.za
Council for Geosciences (Geological Survey)
Private Bag X112
0001 Pretoria, South Africa
Telephone: (27) (12) 841-1911
Fax: (27) (12) 841-1203 or 1221
Internet: http://www.geoscience.org.za
Department of Minerals and Energy
Mineralia Centre
391 Andries St., Private Bag X59
0001 Pretoria, South Africa
Telephone: (27) (12) 317-9000
Fax: (27) (12) 322-4954
Internet: http://www.dme.gov.za
Mine Health and Safety Inspectorate
Telephone: (27) (12) 317-9127
Fax: (27) (12) 320-2105
Internet: http://www.dme.gov.za/mhs/default.htm
Mineral Development Branch
Mineral Economics Directorate (Minerals Bureau)
Telephone: (27) (12) 317-9000
Fax: (27) (12) 320-4327
Internet: http://www.dme.gov.za/minerals/default.htm
Energy Branch
Telephone: (27) (12) 317-9127
Fax: (27) (12) 320-2105
Internet: http://www.dme.gov.za/energy/default.htm
Department of Trade and Industry
Private Bag X274
0001 Pretoria, South Africa
Telephone: (27) 12 3322-7677
Fax: (27) 12 322-7851
Internet: http://wwwdti.pwv.gov.za/dtiwww/Home.htm
Embassy of South Africa
3051 Massachusetts Ave. NW
Washington, DC 20008
Telephone: (1) (202) 232-4400
Fax: (1) (202) 265-1607
Internet: http://www.saembassy.org
Industrial Development Corp. of South Africa Ltd.
P.O. Box 784055,
2146 Sandton, South Africa
Telephone: (27) 11 269-3000
Fax: (27) (11) 269-3116
Minerals and Energy Policy Centre
7th Floor, Block 9, 200 Hans Strijdom Drive
2125 Randburg, South Africa
Telephone: (27) (11) 709 4665
Fax: (27) (11) 709 4595
E-mail: info@mepc.org.za
Internet: http://www.mepc.org.za
Mintek (Council for Mineral Technology)
Private Bag X3015
2125 Randburg, South Africa
Telephone: (27) (11) 709-4111
Fax: (27) (11) 709-4326
Internet: http://www.mintek.ac.za
National Union of Mineworkers
7 Rissik Street, Cnr Frederick Street
P.O. Box 2424
2001 Johannesburg, South Africa
Tel: (27) (011) 377 2000
Fax: (27) (011) 836 6051
E-mail: tmlabatheki@num.org.za
Internet: http://www.num.org.za

Major Publications

Chamber of Mines of South Africa:
Annual Report.
Statistical Tables, annual
Department of Mineral and Energy Affairs: Annual Report.
Mineral Economics Directorate (Minerals Bureau):
South Africa's mineral industry, annual.
Mineral Production and Sales Statistics, monthly.
Periodic directories, some of which are available online via the dropdown menu under "Publications" at http://www.dme.gov.za. Recent directories include the following:
D1/2001 Operating mines, quarries and mineral processing plants
D2/2001 Operating and developing coal mines
D3/2001 Operating gold mines and recovery plants
D4/2001 Review of salt industry
D6/2001 Platinum-group metal mines
D7/2002 Diamond handbook and operating diamond mines
D8/2002 Ferrous minerals and producers
D9/2002 Producers of dimension stone
D10/2002 Producers of non-ferrous metals
D11/2002 Producers of industrial minerals
D12/2002 Operating and developing black empowerment mining companies
D13/2002 African mining companies, government depts & related organization
D14/2002 Producers of sand and aggregate

Digitized by Google

TABLE 1
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000	2001
METALS						
Aluminum metal, primary		673,043	677,000	689,230 r/	674,167 r/	662,497
Antimony concentrate: 2/						
Gross weight		5,888	7,316	9,100	6,288	8,181
Sb content (59.8% Sb)		3,415	4,243	5,278	3,710	4,827
Chromite, gross weight:						
44% to 48% chromic oxide	thousand tons	2,279 r/	2,329	2,447	2,261	2,180
Less than 44% chromic oxide	do.	3,883 r/	4,151	4,370	4,360	3,322
Total	do.	6,162 r/	6,480	6,817	6,621	5,502
Cobalt:						
Mine output, Co content e/		465	435	450	580	550
Refinery output:		318	296	306	397	373
Copper:						
Mine (company output), Cu content		153,058	164,000	144,263	137,092	141,865
Metal:						
Smelter		163,600	152,300	149,300	172,800	142,500
Refined, primary		130,200	125,600	134,500	126,100	132,078
Gold, primary	kilograms	491,680	465,100	451,300	430,816 r/	394,535
Iron and steel:						
Ore and concentrate:						
Gross weight	thousand tons	33,225	32,965	29,512	33,707	34,757
Fe content (62%-65%)	do.	20,600 e/	20,438	18,442	21,570 r/	22,244
Metal:						
Pig iron	do.	6,192	5,650	4,587	6,300	5,800
Direct-reduced iron	do.	1,120	1,070	1,260	1,530	1,560
Ferroalloys, electric arc furnace:						
Chromium ferroalloys	do.	1,940	2,025	2,155	2,574	2,141
Ferromanganese	do.	499 r/	542	527	597	498
Ferrosilicon	do.	102	108	106	109 r/	108
Ferrovanadium e/	do.	5	6	6	18	18
Silicomanganese e/	do.	266	265	267	310 r/	253
Silicon metal	do.	34	33	36	40	39
Steel:						
Crude	do.	8,311	7,679	6,830 r/	8,481 r/	8,821
Stainless		439	430	450 r/e/	436	440
Lead:						
Concentrate, Pb content		83,114	84,128	80,191	75,280	50,771
Smelter, secondary		43,000	50,000	55,000	46,124 r/	48,909
Manganese:						
Ore and concentrate, gross weight:						
Metallurgical:						
More than 48% manganese	thousand tons	1,809	1,734	1,876	2,047	2,082
45% to 48% manganese	do.	84	12	12	302	--
40% to 45% manganese	do.	116	218	235	235	326
30% to 40% manganese	do.	1,111	1,049	970	1,029	832
Total 3/	do.	3,120	3,013	3,093	3,613	3,240
Chemical, 35% to 65% manganese dioxide	do.	33	31	29	22	26
Grand total	do.	3,153	3,044	3,122	3,635	3,266
Metal, electrolytic e/	do.	40	40	40	40	40
Nickel:						
Mine output, concentrate, nickel content e/		34,830	36,679	36,200	36,616	36,443
Metal, electrolytic		28,830 r/	29,039	28,345 r/	30,900	30,900 e/
Platinum-group metals: e/						
Platinum	kilograms	115,861	116,483	121,304	114,459	129,746
Palladium	do.	55,675	56,608	58,164	58,818	62,142
Rhodium	do.	11,664	11,633	12,752	12,067	13,453
Other 5/ e/	do.	13,266	15,419	24,259 r/	24,426	23,406
Total	do.	196,466	200,143	216,479 r/	209,770	228,747
Silver	do.	144,000 r/	144,482 r/	151,959 r/	144,143	109,570

See footnotes at end of table.

Digitized by Google

TABLE 1--Continued
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000	2001
METALS--Continued						
Titanium: e/						
Ilmenite concentrate	thousand tons	2,240 r/	2,300	1,851 r/	1,800	1,750
Rutile concentrate	do.	123	130	100 r/	130	120
Total	do.	2,360	2,430	1,950	1,930	1,870
Titaniferous slag 5/	do.	1,100	1,100	1,168 r/	1,057 r/	1,140
Uranium oxide		1,324	1,138	1,084 r/	1,015	1,065
Vanadium, vanadium metal content		15,590 r/	18,868 r/	17,612	18,021	18,184
Zinc:						
Concentrate:						
Gross weight e/		132,000	129,000	129,200 r/	116,100	113,400
Zn content		71,062	69,630	69,733	62,703	61,221
Metal, smelter, primary		108,500	107,400	108,000	103,000	109,000
Zirconium concentrate (baddeleyite and zircon) e/		265,000	265,000	219,000 r/	253,000	262,000
INDUSTRIAL MINERALS						
Aluminosilicates:						
Andalusite		251,203	236,200	136,949	182,674	193,225
Sillimanite		--	65	--	--	--
Asbestos:						
Chrysotile		49,754	27,195	18,700	18,782	13,393
Crocidolite		232	--	--	--	--
Total		49,986	27,195	18,700	18,782	13,393
Barite		2,071	610	2,844 r/	1,628	--
Calcite		2,886	2,764	2,800 e/	2,800 e/	2,800 e/
Cement, hydraulic, sales	thousand tons	9,797 r/	9,581 r/	9,008 r/	8,991	9,165
Clays:						
Attapulgite		9,349	7,800	7,008 r/	10,287	9,299
Bentonite		75,500	48,382	49,261 r/	85,187	108,300
Fire clay		89,600	143,500	119,450 r/	112,637	141,303
Flint clay, raw and calcined		91,700	82,787	88,864	47,256	50,848
Kaolin		164,400	138,300	123,173 r/	88,897 r/	82,500
Brick clay, local sales	thousand tons	4,137	3,518	3,289 r/	5,347	5,823
Diamond, natural:						
Gem e/	thousand carats	4,500	4,700	4,400	4,745	4,467
Industrial e/	do.	5,586	6,051	5,622	6,060	6,700
Total	do.	10,086	10,751	10,022	10,805	11,167
Feldspar		68,100	56,400	59,336	66,774	66,100
Fluorspar:						
Acid-grade		201,000	222,000 r/	203,280 r/	201,737 r/	272,068
Ceramic-grade e/		4,000	--	--	--	--
Metallurgical-grade		2,000	15,000 r/	14,000 r/	10,618 r/	14,319
Total		207,000	237,000 r/	217,280 r/	212,355	286,387
Gemstones, semiprecious, Tiger's eye	kilograms	64,300	87,200	80,000 e/	80,000 e/	80,000 e/
Gypsum, crude		396,900	485,749	505,404 r/	413,105	382,830
Industrial or glass sand (silica)	thousand tons	2,463	2,223	2,170	2,138	2,132
Lime	do.	1,585	1,523	1,920	1,391	1,615
Magnesite, crude		76,699	74,300	64,000 r/	63,000 r/	33,900
Mica, scrap and ground		1,423	1,556	1,010	708	1,044
Nitrogen, N content of ammonia		752,400	722,800	784,800	560,200	505,900
Perlite		403	400 e/	400 e/	400 e/	400 e/
Phosphate rock:						
Gross weight	thousand tons	2,732	2,739	2,957 r/	2,796	2,420
Phosphorus pentoxide content e/	do.	1,066	1,068	1,153 r/	1,083	937
Pigments, mineral, natural:						
Ochers		186	122	118	550	801
Oxides		98	64	98	80	51
Total		284	186	216	630	852
Salt		322,442	356,059	388,380 r/	345,632	356,075
Sodium sulfate, natural		49,071	48,613	53,400	49,712	57,759
Stone, n.e.s.:						
Dimension:						
Granite and norite 6/		804,300	669,363	782,000	648,818	716,294
Slate		11,000	23,547	24,500	24,952	40,984

See footnotes at end of table.

Digitized by Google

TABLE 1--Continued
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000	2001
INDUSTRIAL MINERALS--Continued						
Stone, n.e.s.--Continued:						
Crushed and broken:						
Limestone and dolomite	thousand tons	22,214	19,754	19,030	15,881	18,764
Nepheline syenite		114,201	11,500 e/	--	--	--
Quartzite	thousand tons	8,500	10,203	8,360	7,965	7,412
Shale:						
For cement	do.	334	279	286 r/	294	243
Other 6/	do.	3,000 e/	3,707	3 r/	7,358	67
Total	do.	3,300	3,986	2,850	7,661	310
Aggregate and sand, n.e.s.	do.	31,692 r/	31,752 r/	29,261 r/	28,402 r/	26,416
Sulfur:						
S content of pyrite (53.45%)	do.	167	152	141	146	150
Byproduct:						
Metallurgy e/	do.	47	122	126	268	265
Petroleum	do.	256	178	139	184	123
Total	do.	470	452	406	452	388
Talc and related materials:						
Talc		12,574	11,328	7,900	5,600	3,030
Pyrophyllite (wonderstone)		10,610	11,500	13,277	11,989	14,386
Vermiculite		211,000	221,300	217,800	208,835	166,078
MINERAL FUELS AND RELATED MATERIALS						
Coal (salable product):						
Anthracite	thousand tons	1,997	2,064 r/	1,919 r/	1,618	1,607
Bituminous	do.	216,600 r/	222,283	221,541	222,500	221,893
Total	do.	218,597 r/	224,347 r/	223,460 r/	224,118	223,500
Natural gas	million cubic meters	1,756	1,560	2,039	2,088	3,000 e/
Petroleum: 7/						
Crude	thousand 42-gallon barrels	3,744	6,549	5,493	6,606	13,870
Refinery products:						
Liquefied petroleum gases	do.	3,650	3,650	3,650 r/e/	3,650	3,650 e/
Gasoline	do.	67,525	67,525	67,000 r/e/	67,000	67,000 e/
Jet fuel	do.	11,315	12,410	12,000 r/e/	12,000	12,000 e/
Kerosene	do.	6,205	7,300	7,000 r/e/	7,000	7,000 e/
Distillate fuel oil	do.	39,785	55,115	55,000 r/e/	55,000	55,000 e/
Residual fuel oil	do.	19,345	24,090	24,000 r/e/	24,000	24,000 e/
Lubricants (including greases) e/	do.	3,650	3,650	3,650 r/e/	3,650	3,650 e/
Other e/	do.	10,585	8,760	8,700 r/e/	8,700	8,700 e/
Total 8/	do.	162,060	182,500 r/	181,000 r/e/	181,000	181,000 e/

e/ Estimated. r/ Revised. -- Zero.

1/ Table includes data available through December 2002.

2/ Data are for the year ending June 30 of that stated.

3/ Difference between total production reported by Minerals Bureau and platinum, palladium, and rhodium supplies (shipments) reported in Johnson and and Matthey Annual Platinum Review. Includes ruthenium and iridium production plus excess platinum, palladium, and rhodium inventory.

4/ Estimated data are rounded to no more than thee significant figures; may not add up to totals shown.

5/ Except for about 45,000 metric tons per year slag derived from titaniferous magnetite by Highveld Steel, titaniferous slag is all from the smelting of ilmenite and likely represents most of that mineral's production, for which data are unavailable.

6/ Converted from reported cubic meters using 1 cubic meter = 2.7 tons.

7/ In addition, Sasol produces about 67 million barrels per year of synthetic liquid petroleum fuels from coal.

8/ Excludes refinery fuel and losses.

Digitized by Google

TABLE 2
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY 1/

(Thousand metric tons unless otherwise specified)

Major commodities	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum	BHP Billiton Aluminium South Africa (Pty.) Ltd. (BHP Billiton PLC., 100%)	Bayside smelter at Richards Bay	175.
Do.	do.	Hillside smelter at Richards Bay (planned expansion by 2003)	500+ (increase to 650).
Andalusite	Rhino Minerals (Pty.) Ltd. [Mircal South Africa (Pty.) Ltd., 100%, acquired from Anglovaal Minerals Ltd. (Avmin) in July 1999]	Rhino Mine near Thabazimbi	120.
Do.		Havercroft Mine at Penge, north of Steelpoort	60.
Do.	Samrec Pty. Ltd. of France (private, 100%) (Ilmerys Group)	Annesley Mine at Penge, 50 kilometers north of Steelpoort	75.
Do.	do.	Andalusite Refractories Mine at Groot, Marico, 60 kilometers west of Rustenburg (plant mothballed in 2000; pilot plant for stauralite in 2001)	12.
Do.	do.	Krugerspost Mine, near Lydenburg	50.
Do.	Hoogenoeg Andalusite (Pty.) Ltd. (Hernic Group)	Hoogenoeg Mine, 60 kilometers northeast of Potgietersrus	15.
Do.	do.	Buffelshoek near Thabazimbi	NA.
Antimony	Consolidated Murchison Ltd. [Metorex Pty. Ltd., 34.3%; Crew Development Corp. (Canada), 3.3%]	50 kilometers west of Phalaborwa	7 Sb concentrate, 1,000 kg gold byproduct.
Asbestos	Kaapsehoop Asbestos Pty. Ltd.	New Amianthus Mine in Mpumalanga	NA (chrysotile).
Do.	African Chrysotile Asbestos Ltd.	Msauli Mine near Barberton (closed)	NA (chrysotile).
Do.	Anglo Dutch Exploration & Mining Co. (Pty.) Ltd.	Stella Mine, east of Barberton (closed)	NA (chrysotile).
Do.	Griqualand Exploration and Finance Corp.	Kuruman Mine (closed in 1998)	NA (crocidolite).
Cement	Anglo Alpha Ltd. (Holderbank; Anglovaal Industries Ltd.).	Dudfield kiln near Lichtenburg, also grinding mill at Roodepoort	1,830.
Do.	do.	Ulco kiln 60 kilometers northwest of Kimberley	1,615.
Do.	Lafarge South Africa Ltd. [Lafarge (France)] [formerly Blue Circle Cement (Pty.) Ltd.]	Lichtenburg kiln, North West Province	2,400.
Do.	do.	White's kiln	200.
Do.	Natal Portland Cement Co. (Pty.) Ltd. (co-owned by Anglo Alpha, Cimentos de Portugal, and Lafarge)	Simumu plant, 125 kilometers southwest of Durban; grinding mills at Durban and Newcastle	1,500.
Do.	Pretoria Portland Cement Co. Ltd. (Barlow Rand Group, 60.3%)	De Hoek, Dwaalboom, Herculese, Jupiter, Slurru, Riebeeck West, and Port Elizabeth kilns	5,500 (combined), clinker.
Chromite	Samancor Ltd. (BHP Billiton PLC., 60%, Anglo American plc, 40%)	Eastern Chrome Mines in Steelpoort Valley, Mpumalanga Province, includes: Lannex, Groothoek, Jagdlust, Mooihoek, , Tweefontein, and Steelpoort mines	2,200 run-of-mine ore.
Do.	do.	Western Chrome Mines in Northern Province includes Elandsdrift, Mooinooi, Ruighoek, and Waterkloof-Millsell mines	1,800 run-of-mine ore.
Do.	Chromecorp Holdings Ltd. [Xstrata Ag, nee Sudelektra Holdings AG, (Switzerland) 100%]	Kroondal Mine east of Rustenburg	1,260 ore; 880 concentrate.
Do.	do.	Wonderkop Mine east of Rustenburg	720 ore; 400 concentrate.
Do.	do.	Chroombronne Mine, near Rustenburg	576 ore; 432 concentrate.
Do.	do.	Purity Mine, near Rustenburg	360 ore; 252 concentrate.
Do.	Hernic Ferrochrome Pty. Ltd. [South African Chrome and Alloys Ltd.; EL Daniel (Germany); Nittetsu Shoji (Japan)]	Hernic Chrome Mine near Brits, North West Province, and Mooinooi Mine near Rustenburg	NA.
	Bayer Pty. Ltd.	Rustenburg Chrome Mine	NA.
Do.	Lavino South Africa (Pty.) Ltd. (Anglovaal Minerals Ltd., 51%; Middle Witwatersrand, 49%)	Grootboom Mine, near Lydenburg	500 ore.
Do.	Dilokong Chrome Mine (Pty.) Ltd. (Mining Corp. Ltd., 100%)	Dilokong Mine, near Lydenburg	480 ore.
Do.	Associated Manganese Mines of South Africa Ltd., (Anglovaal Minerals Ltd., 50.2%; Associated Ore & Metal Corp., 45.2%)	Dwarsrivier Mine	1,000 run-of-mine ore.
Coal	Ingwe Coal Corp. Ltd. (Billiton Plc., 100%)	10 collieries in Mpumalanga and KwaZulu-Natal Provinces	59,000 anthracite and bituminous.

See footnotes at end of table.

Digitized by Google

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY 1/

(Thousand metric tons unless otherwise specified)

Major commodities		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Coal--Continued:		Amcoal Colliery and Industrial Operations Ltd. (Anglo American Plc. (52%)	8 collieries: Arnot, Bank, Goedehoop, Kriel, New Denmark, New Vaal, SA Coal Estates, and Vryheid Coronation, in Mpumalanga and KwaZulu-Natal Provinces	52,000 anthracite and bituminous.
Do.		Duiker Mining Ltd. (Xstrata plc, 100% as of 2002)	Tweefontein Division (Waterpan, Boschmans, Witcons, and South Witbank mines	4,500.
Do.		do.	Mpunzi Division (Phoenix, Tavisstock, ATC, and ATCOM mines)	6,200.
Do.		do.	Mpumalanga Division (Strathae, Tselentis, and Spitzkop mines)	3,200.
Do.		do.	Goedgevonden Mine (opens 2004)	
Do.		do.	Ingwe manged operations including Rietspruit JV, 50%; Douglas Tavistock JV, 16% (Douglas and Middleburg Mines)	29,000.
Do.		Duvha Opencast Services (Pty.) Ltd. (Rand Mines Ltd., 71%)	Duvha Colliery, 18 kilometers southeast of Witbank	11,000 bituminous.
Do.		Kangra Group Pty. Ltd.	Savamore, Springlake, Taaboschpruit, and Welgedacht collieries.	4,300 bituminous and steam.
Do.		Sasol Mining (Pty.) Ltd. (Sasol, 100%)	Sigma Colliery, 2 mines, 75 kilometers south of Johannesburg (closed 1999).	5,500 bituminous.
Do.		do.	Secunda Collieries, 6 mines, 75 kilometers south of Witbank	43,000 bituminous.
Do.		Kumba Resources	Grootegeluk Mine, 120 kilometers north of Thabazimbi	12,000 steam coal; 2,000 coking coal; 450 metallurgical coal.
Do.		do.	Leeuwpan Colliery in Mpumalanga Province	1,250 steam coal.
Do.		do.	Durnacol Mine at Dannhauser, 40 kilometers south of Newcastle	530 coking coal.
Do.		do.	Tshikondeni Mine in Venda, about 100 kilometers southeast of Messina	410 coking coal.
Do.		Anglovaal Minerals Ltd. (100%)	Dortsfontein Colliery	700.
Do.		do.	Forzando Colliery	1,350.
Do.		Newcoal (Eyesizwe Coal (Pty) Ltd., 80%; Anglo Coal, 11%; Ingwe Coal Corp. Ltd., 9%)	Matla, Arnot underground, Glisa, and New Clydesdale collieries	18,000.
Do.		Kuyasa Mining (Pty.) Ltd.	Ikhewezi mine, near Delmas	350.
Do.		Gold Fields Coal Ltd.	Greenside and New Clydesdale Collieries	3,000.
Do.		Anker Holdings B.V. (Netherlands)	Elandsfontein, Golfview, Van Oudshoornstrom, and Woestalleen collieries	5,000. e/
Do.		Wakefield Coal Division, [Metorex Pty. Ltd., 40.07% (Canada)]	Leeuwfontein and Side collieries in Witbank Coalfield	1,300 steam.
Copper		Palabora Mining Co. Ltd. (Rio Tinto Ltd., 46.4%; Anglo American plc/De Beers, 29%)	Palabora open pit mine and plant at Phalaborwa 3/	130 metal in ore.
Do.		do.	Smelter at Phalaborwa	140 anodes.
Do.		do.	Refinery at Phalaborwa	125 cathodes.
Do.		O'okiep Copper Co. Ltd. [Metorex (Pty.) Limited, 89%]	Nigramoep copper mine, near Nababeep, Northern Cape Province	15 Cu in concentrates.
Do.		do.	O'okiep smelter at Nababeep	42 blister.
Do.		Black Mountain Mineral Development Co. (Pty.) Ltd. (Anglo American plc., 100%)	Black Mountain Mine near Aggeneys, 100 kilometers northeast of O'okiep	5 Cu in concentrate.
Do.		Maranda Mining Co. [Metorex (Pty.) Limited, 29.1%]	Maranda zinc-copper mine in Murchison Range in Northern Province	1.6 Cu metal.
Diamond	thousand carats	De Beers Consolidated Mines Ltd., (Anglo American plc, 29%)	Finsch Mine, 100 kilometers west of Kimberley	2,500. e/
Do.	do.	do.	Kimberley Mine, Kimberley	800. e/
Do.	do.	do.	Koffiefontein Mine, 70 kilometers south of Kimberley	200. e/
Do.	do.	do.	Namaqualand Mines, 50 kilometers north of Port Nolloth	800. e/
Do.	do.	do.	Premier Mine, 70 kilometers east of Pretoria	1,700. e/
Do.	do.	do.	Venetia Mine, 150 kilometers north of Potgietersrus	5,000. e/

See footnotes at end of table.

Digitized by Google

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY 1/

(Thousand metric tons unless otherwise specified)

Major commodities		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Diamond--Continued	thousand carats	SouthernEra Resources Ltd. (Canada) (in joint venture with De Beers or Randgold Resources on some operations)	Klipspringer project, includes 10 kimberlite fissures and pipes near Potgietersrus in Northern Province	1,000.
Do.	do.	Benguela Concessions Ltd.	Several marine operations along Namqualand coast; Moonstone mining ship	40.
Do.	do.	Trans Hex Group Ltd.	Baken deposit on Orange River; So Ver, Reuning, Komagass, and Hondklip Bay Mines, and three marine operations off Northern Province	200.
Do.	do.	Trivalence Mining Corp. of Canada, (100%)	Palmietgat kimberlite mine	50.
Fluorspar		Vergenoeg Mining Corp. (Pty.) Ltd. [Metorex Pty. Ltd., 70%; Minerales y Productos Derivados SA (Spain), 30%]	Vergenoeg Mine, 75 kilometers north of Pretoria	125 acid-grade fluorspar; 10 metallurgical-grade fluorspar.
Do.		Witkop Fluorspar Mine (Pty.) Ltd. [South Africa Land & Exploration Co. (Sallies)] [Athlone International (Australia), 100%)]	Witkop Mine, 250 kilometers west of Johannesburg	140 acid-grade fluorspar (expand to 280 by 2002).
Do.		Van den Heever Fluorspar Works	Van Den Heever Mine, 120 kilometers west of Johannesburg	50 metallurgical-grade fluorspar. e/
Gold	tons	AngloGold Ltd.	Vaal River Operations; includes Great Noligwa (ex-Vaal Reefs Shaft 8), Kopanang (Vaal Reefs #9), and Tau Lekoa (Vaal Reefs #10) underground mines; Vaal River surface operations; and Moab Khotsong development	60 Au.
Do.	do.	do.	Ergo Operations: Slimes dam reprocessing	11 Au.
Do.	do.	AngloGold Ltd.	West Wits Operations; includes Tau Tona (ex-Western Deeps-East), Savuka (ex-Western Deeps-West), Mponeng (ex-Western Deeps-South) underground mines; and Western Ultra Deep Levels project	42 Au. 12 Au by 2003.
Do.	do.	Gold Fields Ltd.	Beatrix, Driefontein, Kloof, Oryx, St. Helena, and Target mines; west and southwest of Johannesburg	125 Au (South African operations only).
Do.	do.	Harmony Gold Mining Co. Ltd.	Free State Operations (shafts include Harmony 2 and 4; Merriespruit 1, 7, and 3; Virginia, Unisel, Masimong 4 and 5; Brand 2, 3, and 5); Central, Saaiplaas, and Virginia metallurgical plants; and Central refinery	26.5 Au.
Do.	do.	do.	Deelkraal and Elandsrand mines	18 Au.
Do.	do.	do.	Evander Operations--Includes six shafts and Kinross, Leslie, and Winkelhaak metallurgical plants.	13 Au.
Do.	do.	do.	Randfontein Operations--Includes Cooke 1, 2, and 3, and Doornkop shafts, and No. 4 and Doornkop metallurgical plants; and Doornkop South Reef development	22.5 Au.
Do.	do.	do.	Lindum open pit operations (closed in 2001)	(4/).
Do.	do.	do.	Kalgold open pit, heap leach and carbon-in-leach operation at Mafikeng, Northwest Province	3.2 Au.
Do.	do.	Free Gold (Pty.) Ltd. (Harmony Gold Mining Co. Ltd., 50%; African Rainbow Minerals (Pty.) Ltd, 50%) (acquired from AngloGold at end of 2001)	Free State Operations; includes Bambanani, Tshepong, Matjhabeng, and Joel underground mines and Free State surface operations	48 Au.
Do.	do.	Avgold Ltd. (Anglovaal Mining Ltd., 60.1%)	Eastern Transvaal Consolidated Division (Fairview, New Consort, and Sheba Mines), near Klerksdorp	2.8 Au.
Do.	do.	do.	Target mine development	10.9 Au by 2002.
Do.	do.	Durban Roodeport Deep Ltd. (Khumo Bathong Holdngs, 3%)	Blyvoorruitzicht and Doornfontein Section	6.3 Au.
Do.	do.	do.	Buffelsfontein Section	5.5 Au.
Do.	do.	do.	Hartebeestfontein Section	15.5 Au.

See footnotes at end of table.

Digitized by Google

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY 1/

(Thousand metric tons unless otherwise specified)

Major commodities		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Gold--Continued	tons	Durban Roodeport Deep Ltd. (Khumo Bathong Holdngs, 3%)	Argonaut Deep project on hold (60-million-troy-ounce gold resource)	
Do.	do.	do.	Crown Section--tailings retreatment	4.1 Au.
Do.	do.	Western Areas Ltd. (JCI Gold, 50%; Placer Dome Inc., 50%)	Western areas	6 Au.
Do.	do.	do.	South Deep project	11.7 Au by 2002.
Do.	do.	Rand Refinery Ltd.	Germiston, Gauteng Province	1,200 refined Au.
Iron and steel:				
Iron ore		Kumba Resources [Iscor Ltd. (75%), Anglo American plc (20%)]	Sishen Mine at Sishen	27,000 ore, to 32,000 by 2002.
Do.		do.	Thabazimbi Mine at Thabazimbi	2,900 ore.
Do.		Highveld Steel and Vanadium Corp. Ltd. (Anglo American plc, 74%)	Mapochs Mine at Roossenekal, 60 kilometers west of Lydenburg	3,000 titaniferous and vanadiferous magnetite ore.
Do.		Associated Manganese Mines of South Africa Ltd. (Anglovaal Minerals Ltd., 50.2%)	Beeshoek Mine near Postmasburg (New Beeshoek South Mine commissioned in 2001)	6,000 ore.
Ferroalloys 2/		Samancor Chrome Division (BHP Billiton Plc, 60%; Anglo American plc, 40%)	Ferrometals plant at Witbank (6 furnaces) (2 furnaces, 110,000 capacity closed in 1999) [F1 and F2 20-megawatt furnaces (80,000 metric tons per year) closed August 2000]	450 ferrochromium.
Do.		do.	Tubatse Ferrochrome plant at Steelpoort (6 furnaces)	340 ferrochromium.
Do.		do.	Middelburg Ferrochrome plant 35 kilometers east of Witbank (3 furnaces)	235 ferrochromium.
Do.		do.	Palmiet Ferrochrome plant at Krugersdorp, 30 kilometers west of Johannesburg (3 furnaces closed November 2001)	120 ferrochromium.
Do.		do.	Bathlako Ferrochrome plant at Ruighoek, northwest of Rustenburg	20 ferrochromium.
Do.		Chromecorp Holdings Ltd. [Xstrata AG, nee Sudelektra Holding AG (Switzerland), 100%]	Rustenburg (6 furnaces)	400 ferrochromium.
Do.		do.	Lydenburg (4 furnaces)	350 ferrochromium.
Do.		do.	Wonderkop (4 furnaces)	320 ferrochromium.
Do.		do.	Rustenburg slag retreatment plant	25 ferrochromium.
Do.		do.	Wonderkop slag retreatment plant	20 ferrochromium.
Do.		do.	Silicon Technology plant at Ballengeich, KZN	55 ferrosilicon.
Do.		Samancor and Xstrata joint venture (Billiton plc., 50%; Xstrata AG, 50%)	Wonderkop furnace (2 furnaces) (comissioned mid-2001)	170 ferrochromium.
Do.		South African Chrome and Alloys Ltd.	Elandsdift and Horizon Chromite Mines	150 ferrochromium.
Do.		do.	Proposed new ferrochrome smelter planned	150-170 ferrochromium.
Do.		Hernic Ferrochrome Pty. Ltd. [South African Chrome and Alloys Ltd; EL Daniel (Germany); Nittetsu Shoji (Japan)]	Plant near Brits (2 furnaces)	260 ferrochromium.
Do.		Feralloys Ltd. (Associated Manganese Mines of South Africa Ltd., 100%)	Machadadorp plant (3 furnaces), 80 kilometers east of Middelburg	150 ferrochromium, 175 by 2000.
Do.		Cato Ridge Alloys Ltd. (Associated Manganese Mines of South Africa Ltd., 50%, Mizushima Ferroalloy Co. Ltd.,40%; Sumitomo Corp., 10%)	Cato Ridge, 75 kilometers west of Durban	245 ferromanganese.
Do.		Samancor Manganese Division (Billiton plc., 54.6%; Anglo American plc, 28.9%; other private, 16.5%)	Metalloys Ltd. plant at Meyerton (9 furnaces), 50 kilometers south of Johannesburg; can switch between FeMn and SiMn	530 high-carbon ferromanganese, 200 silicomanganese.
Do.		Advalloy (Pty.) Ltd. (Billiton/Samancor, 50%; Japan Metals & Chemicals Co., 35%; Mitsui & Co. Ltd., 15%)	Furnace at Samancor's Meyerton Plant	75 low-carbon and high-carbon ferromanganese.
Do.		Manganese Metal Co. (Pty.) Ltd. (Samancor Ltd.)	Plants at Krugersdorp and Nelspruit	44 electrolytic manganese.
Do.	tons	ASA Metals (Pty.) Ltd. (Eastern Asia Metal Investment Co. Ltd., 60%; Northern Province Development Corp., 40%)	Plant near Pietersburg, Northern Province (associated with Dilokong Chrome)	50 ferrochrome.
Do.	do.	Vametco Minerals Corp. (Strategic Minerals Corp., USA, 100%)	Smelter near Brits	5,250 ferrovanadium.

See footnotes at end of table.

Digitized by Google

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY 1/

(Thousand metric tons unless otherwise specified)

Major commodities	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iron and steel--Continued:			
Ferroalloys--Continued:	Transalloys Division (Highveld Steel and Vanadium Corp. Ltd., 100%)	Witbank	50 medium-carbon ferromanganese.
Do.	do.	do.	175 silicomanganese.
Do.	Rand Carbide Division, Highveld Steel and Vanadium Corp. Ltd., (100%)	Plant at Witbank, Mpumalanga Province	58 ferrosilicon.
Steel	Iscor Ltd.	Vanderbijlpark Works	3,200 flat products.
Do.	do.	Newcastle Works	2,000 profile products.
Do.	do.	Vereeniging Works	450 e/ specialty steels.
Do.	Highveld Steel and Vanadium Corp. Ltd. (Anglo American plc, 74%)	Witbank	1,000 cast billets, blocks, and slabs.
Do.	Saldanha Steel (Pty.) Ltd. (Iscor Ltd., 50%; Industrial Development Corp., 50%)	Hot-rolled steel coil plant at Saldanha Bay	1,200.
Do.	Columbus Stainless (Samancor, 33.3%; Highveld Steel and Vanadium Corp. Ltd., 33.3%; Industrial Development Corp., 33.3%)	Stainless steel plant at Middelburg	500.
Do.	Scaw Metals Division, Anglo Operations Ltd.	Germiston plant, Johannesburg	500 speciality castings and rolled products.
Do.	Duferco Steel Processing Ltd.	Cold-rolled slab steel at Saldanha Bay	400.
Do.	Davsteel Division, Cape Gate Pty. Ltd.	Vanderbijlpark plant, Gauteng	400 rebar, wire rod, and other shapes.
Do.	Cape Town Iron & Steel Works (Pty.) Ltd. (CISCO)	Kuilsrivier plant, Cape Town	180 rebar.
Manganese	Associated Manganese Mines of South Africa Ltd. (Avmin Ltd., 50.2%)	Gloria and N'Chwaning Mines near Black Rock, 70 kilometers north of Sishen	1,500 ore.
Do.	Samancor Ltd. (BHP Billiton plc, 60%; Anglo American plc, 40%).	Mamatwan open pit mine and Mamatwan ore sintering plant, near Hotazel	2,200 ore, of which 1,100 sintered ore.
Do.	do	Wessels underground mine, near Hotazel	1,200 ore.
Do.	Manganese Metal Co. Pty. Ltd. (Samancor Ltd., 100%)	Electrolytic plant, Nelspruit, Mpumalanga	26 manganese metal.
Do.	do.	Electrolytic plant, Krugersdorp, Gauteng	18 manganese metal.
Do.	Metmin (Metorex Pty. Ltd., 100%)	Open pit mine in Northwest Province (used as catalyst for extracting uranium from gold)	24 manganese dioxide.
Nickel	Nkomati Joint Venture (Anglovaal Mining Ltd., 75%; Anglo American plc, 25%)	Nkomati Mine in Mpumalanga Province	15 nickel in concentrate.
Petroleum, crude million 42-gallon barrels	Soeker (Government, 100%)	Oribi field 140 km southwest offshore from Mossel Bay	9.1.
Do. do.	do.	Oryx field	1.8 e/.
Do. do.	Mossgas [Government, 100% (through Central Energy Fund]	9 wells in Mossel Bay	3.5.
Do. do.	Shell and BP Refineries Pty. Ltd. (Shell South Africa, 50%; BP, 50%)	Sanref refinery in Durban	60 crude.
Do. do.	Caltex Oil SA Pty. Ltd. (private, 100%)	Refinery in Cape Town	41 crude.
Do. do.	National Petroleum Refiners of South Africa Pty. Ltd. (SASOL, Total SA)	Natref Refinery in Secunda, 100 kilometers southeast of Johannesburg	32 crude.
Do. do.	Engen Ltd., (62%)	Engen Refinery in Durban	38 crude.
Phosphate	Phosphate Development Corp. Ltd. (Foskor Ltd.) (IDC, 100%)	Foskor mine and plant at Phalaborwa	2,900 phosphate rock. 5/
Do.	Fer-Min-Ore Pty. Ltd. of South Africa	Glenover Phosphate Mine in Guateng, leach old dumps to produce phosphoric acid by 2002	NA.
Platinum-group metals kilograms	Anglo American Platinum Corp. Ltd., (Anglo American Plc., 100%) (Anglo Platinum)	Rustenburg Section near Rustenburg, Rustenburg underground and open pit mines (New Waterval UG2 mine by 2002) (adding 12,285 kilograms per year platinum capacity by 2002)	24,000 platinum metal; 10,260 palladium metal; 1,650 rhodium metal.
Do. do.	do.	Rustenburg mill	9,000 ore.
Do. do.	do.	Union Section, 50 kilometers south of Thabazimbi	9,850 platinum metal; 4,540 palladium metal; 1,470 rhodium metal.

See footnotes at end of table.

Digitized by Google

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY 1/

(Thousand metric tons unless otherwise specified)

Major commodities		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Platinum-group metals--Continued:	kilograms	Anglo American Platinum Corp. Ltd., (Anglo American Plc., 100%) (Anglo Platinum)	Amandelbult Section, 50 kilometers south of Thabazimbi mines	17,700 platinum metal; 8,150 palladium metal; 6,500 rhodium metal.
Do.	do.	do.	Union mill	4,000 ore.
Do.	do.	do.	Amandelbult mill	6,000 ore.
Do.	do.	do.	Lebowa Platinum (Atok) Mine, 70 kilometers east of Potgietersrus	2,520 platinum metal; 1,100 palladium metal; 150 rhodium metal.
Do.	do.	do.	Lebowa Platinum Mill	1,000 ore.
Do.	do.	do.	Potgietersrus Platinum Mine (30 million metric tons per year low grade ore mined, most of which is stockpiled for future use)	5,160 platinum metal; 5,500 palladium metal; 350 rhodium metal.
Do.	do.	do.	Potgietersrus Platinum mill	3,100 ore.
Do.	do.	do.	Bafokeng Rasimone Mine in Northern Province (opened in 2000, full capacity by 2002)	7,776 PGM metal.
Do.	do.	do.	Bafokeng Rasimone mill	2,400 ore.
Do.	do.	do.	Waterval Mine	12,285 PGM.
Do.	do.	do.	Total Amplats mill capacity	23,800 ore.
Do.	do.	do.	Waterval Mill	4,800 ore.
Do.	do.	do.	Waterval smelter	50 converter matte.
Do.	do.	do.	Rustenburg Base Metals Refiners Refinery	25 nickel plus refined copper and cobalt, and precious metals concentrates.
Do.	do.	do.	Precious Metals Refinery--total Amplats capacity	70,000 platinum metal; 34,000 palladium metal; 6,500 rhodium metal.
Do.	do.	Anglo Platinum and African Rainbow Minerals	Maandagshoek Mine (full capacity by 2003)	5,000 platinum metal.
Do.	do.	do.	Maandagshoek mill (to treat UG2 ore)	2,400 ore.
Do.	do.	Impala Platinum Ltd. (Impala Platinum Holdings Ltd., 100%) (Implats)	13 mine shafts and concentrator near Rustenburg, Northwest Province	15,000 ore.
Do.	do.	do.	Smelter	NA.
Do.	do.	do.	Enhanced Precious Metals Refinery near Springs, Gauteng Province	62,200 platinum; 18,000 palladium; 4,600 rhodium.
Do.	do.	do.	Reopening Crocodile River Mine in 2001	1,555 platinum; 930 other PGM.
Do.	do.	do.	Platexco properties, including Winnaarshoek deposit adjacent to Implats Clapham, Forrest Hill, and Dreikop properties; Platexco Mokopane and Septre properties	6,220 PGM
Do.	do.	Lonmin Platinum (Lonmin Plc., 73%; Impala Platinum Holdings Ltd., 27%)	3 mines (Eastern Platinum, Karee, and Western Platinum) near Rustenburg	37,324 PGM (in concentrates); 10,000 ore.
Do.	do.	do	Smelter	6,000 grams per ton PGM (matte).
Do.	do.	do.	Base Metals Refinery	Copper and nickel sulfate, and PGM concentrates.
Do.	do.	Lonmin Platinum (Lonmin Plc., 73%; Impala Platinum Holdings Ltd., 27%)	Precious Metals Refinery, at Western Platinum, 20 kilometers east of Rustenburg	20,600 platinum; 9,330 palladium; 2,800 rhodium.
Do.	do.	Northam Platinum Ltd. (Mvelaphanda Platinum, 22.5%; Anglo Platinum, 20%)	Northam Mine 20 kilometers south of Thabazimbi	13,000 platinum.
Do.	do.	do.	Northam mill (treats merensky ore)	1,800 ore.
Do.	do.	do.	New mill in 2001 (to treat UG2 ore)	900 ore.
Do.	do.	do.	Northam Refinery	5,910 platinum.
Do.	do.	Kroondal Platinum Mines [Aquarius Platinum Ltd., (Australia), 45%, and Implats, 15%]	Kroondal Mine, 10 kilometers east of Rustenburg (opening in 2000)	3,110 platinum; 1,555 palladium; 467 rhodium.
Do.	do.	do.	Kroondal mill	1,200 ore.
Do.	do.	Aquarius Platinum Ltd. (Australia) (Implats, 25%)	Marikana Mine, 20 kilometers southeast of Rustenburg (feasibility study in 2000)	4,665 platinum planned.

See footnotes at end of table.

Digitized by Google

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY 1/

(Thousand metric tons unless otherwise specified)

Major commodities		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Platinum-group metals--Continued:	kilograms	Aquarius Platinum Ltd. (Australia) (Implats, 25%)	Marikana mill	1,540 ore.
Do.	do.	do.	Everest South deposit feasibility study in 2001	5,440 PGM planned.
Do.	do.	Messina Holdings Ltd. (SouthernEra Resources Ltd., 70.4%) (purchased from Implats in 1999)	Messina platinum deposit, near Klipspringer diamond mine, Limpopo Province (2003 startup)	2,176 platinum; 1,681 palladium; 247 rhodium.
Do.	do.	East Daggafontein Ltd. (Mvelaphanda Platinum, 100%)	Tailings dump retretament operation at East Daggafontein	NA.
Pyrophyllite		Alpha Ltd.	Idwala Industrial Minerals plant and Witpoort Quarry	NA.
		Wonderstone Ltd. (The Associated Ore & Metals Corp. Ltd.)	Pyrophylite (wonderstone) mine in Northwest Province	NA.
Do.		G&W Base and Industrial Minerals Pty. Ltd.	Masala Mine, Mpumalanga	NA.
Salt		Salt is mined/extracted from 4 seawater and 50 salt-pan brine operations	Operations are distributed throughout the country with the greatest concentration within a major inland saltpan around the border of the Free State and Northern Cape Provinces	400.
Silicon		Silicon Smelters [Invensil (subsidiary of Pechiney Electrometallurgie), 77%; BHP Billiton plc, 23%]	Polokwane plant near Pietersburg, Limpopo Province (3 submerged arc furnaces)	45 silicon; 15 silica fume.
Synthetic fuels	million 42-gallon barrels	Sasol (Government, 100%)	Coal to oil plant at Secunda and a coal-to-petrochemical plant at Sasolburg	54.8.
Do.	do.	Mossgas (Government, 100% through Central Energy Fund).	Natural gas to petroleum products plant at Mossel Bay	16.4.
Titanium:				
Titanium concentrates		Richards Bay Minerals [trading for Tisands (Pty.) Ltd. and Richards Bay Iron and Titanium (Pty.) Ltd. (Rio Tinto Plc., 50%; BHP Billiton Plc., 50%)	Opencast operations near Richards Bay	1,280 ilmenite concentrate and 125 rutile concentrate. e/
Do.		Namakwa Sands Ltd. [Anglo Operations Ltd., (subsidiary of Anglo American plc), 100%]	Opencast mine near Brand-se-Baai and mineral separation plant at Koekenaap, 300 kilometers northwest of Cape Town	540 ilmenite concentrate; 42 rutile concentrate.
Titanium slag		Richards Bay Iron and Titanium (Pty.) Ltd./ Richards Bay Minerals (Rio Tinto Plc.)	Smelter at Richards Bay	1,000 titania slag.
Do.		Namakwa Sands Ltd. [Anglo Operations Ltd., (subsidiary of Anglo American plc), 100%]	Smelter at Vredenberg, Saldanha Bay area	230 titania slag (by 2000); 120 pig iron.
Do.		Highveld Steel and Vanadium Corp. Ltd.	Steel plant at Witbank	48 titania slag. e/
Uranium	tons	AngloGold Ltd. (Anglo American plc., 60%; De Beers, 40%)	Vaal Reefs Mine and plant near Klerksdorp	2,000 uranium oxide e/ (900 at 1998-9 output).
Do.	do.	Avgold Ltd., (Anglovaal Minerals Ltd., 100%).	Hartebeestfontein Mine and plant, 5 kilometers southeast of Klerksdorp	400 uranium oxide. e/ (<200 at 1998-9 output).
Do.	do.	Palabora Mining Co. Ltd.	Palabora Mine and plant at Phalaborwa	160 uranium oxide. e/
Vanadium	do.	Highveld Vanadium and Chemicals (Anglo American plc through Highveld Steel and Vanadium Corp. Ltd.)	Mapochs Mine near Lydenburg	25,000 vanadium pentoxide. e/
Do.	do.	do.	Highveld steel plant in Witbank	17,000 vanadium pentoxide.
Do.	do.	do.	Highveld Vantra plant in Witbank	8,000 vanadium pentoxide.
Do.	do.	Vametco Minerals Corp. [Strategic Minerals Corp. (United States), 100%]	Krokodilkraal Mine and plant near Brits	5,000 vanadium pentoxide. e/
Do.	do.	Transvaal Alloys Pty. Ltd. (Highveld Steel and Vanadium Corp., 100%)	Wapadskloof Mine and plant, 60 kilometers northeast of Middelburg	2,250 vanadium pentoxide. e/
Do.	do.	Vanadium Technology Ltd. (Xstrata AG, 100%)	Kennedy's Vale (ex-Vansa Vanadium) Mine and plant, near Lydenburg	5,900 vanadium pentoxide 1,500 ferrovanadium.
Do.	do.	Rhombus Vanadium Holdings Ltd. (Xstrata AG, 100%)	Ba-Mogopa Mine and Usko plant	13,500 vanadium.
Vermiculite		Palabora Mining Co. Ltd.	Palabora mine and plant at Phalaborwa	230 concentrate. e/
Do.		Natkruit Vermiculite Mine Pty. Ltd. (Verimex Trading Pty. Ltd.)	Mine near Soutpansberg, Northern Province (closed March 1999)	22 concentrate.
Zinc		Zinc Corp. of South Africa Ltd. (Zincor) (Iscor Ltd., 100%)	Struisbult Springszinc refinery at Springs, southeast of Johannesburg	120 Zn.

See footnotes at end of table.

Digitized by Google

TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY 1/

(Thousand metric tons unless otherwise specified)

Major commodities	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Zinc--Continued:	Black Mountain Mineral Development Co. (Pty.) Ltd. (Anglo American plc., 100%)	Black Mountain Mine near Aggeneys, 100 kilometers northeast of Okiep	26 Zn (in concentrate).
Do.	Maranda Mining Co. [Metorex (Pty.) Limited, 29.1%]	Maranda zinc-copper mine in Murchison Range in Northern Province	15 Zn metal in concentrate; 5.9 Cu metal in concentrate.
Do.	Pering Mine (Pty.) Ltd. (Billiton plc., 100%)	Pering Mine in Northern Cape Province, (closed July 2002)	27 Zn in concentrate; 6 Pb in concentrate.
Zirconium	Tisand (Pty.) Ltd./Richards Bay Minerals	Opencast mines near Richards Bay	300 zircon concentrate.
Do.	Namakwa Sands Ltd. [Anglo Operations Ltd. (subsidiary of Anglo American plc), 100%]	Opencast mine near Brand-se-Baai and mineral separation plant at Koekenaap,	140 zircon concentrate.
Do.	Palabora Mining Co. Ltd.	Palabora Mine and plant at Phalaborwa	14 baddeleyite. e/
Do.	do.	Zirconium basic sulphate plant at Phalaborwa	8 Zr basic sulfate (by 1999).
Do.	Phosphate Development Corp. Ltd. (Foskor Ltd.) (IDC, 100%)	Plant at Phalaborwa	3 baddeleyite. e/
Do.	do.	Fused zirconia plant	6 synthetic zirconia.

e/ Estimated. NA Not available.
1/ Based on information available as of February 2003.
2/ Depending on market demand, furnace capacity can switch between ferrochromium and ferromanganese.
3/ Switch to underground mining in 2002 and reduce capacity to 75,000 metric tons per year of metal ore.
4/ Included in the Randfontein operations of Harmony Gold Mining Co. Ltd.
5/ Most of Foskor's phosphate output is from phosphate concentrates supplied by the neighboring Palabora copper mine.

TABLE 3
SOUTH AFRICA: RESERVE BASE OF MAJOR MINERALS 1/

Commodity		Reserve base
Andalusite 2/	million metric tons	50.8
Antimony	thousand tons	250
Chromium, ore	million metric tons	3,100
Coal, recoverable	do.	34,980
Cobalt 3/	thousand tons	15
Copper	million metric tons	13
Diamond 4/	million carats	1,120
Fluorspar	million metric tons	36
Gold	thousand tons	35.9
Iron ore, Fe content	million metric tons	1,500
Lead	do.	3
Manganese	do.	4,000
Natural gas	billion cubic meters	22
Nickel 3/	million metric tons	11.8
Petroleum	million barrels	29.4
Phosphate rock, concentrates	million metric tons	2,500
Platinum-group metals	thousand tons	62.8
Silver	do.	10
Titanium	million metric tons	146
Uranium 5/	thousand tons	218.3
Vanadium	million metric tons	12
Vermiculite	do.	80
Zinc	do.	15
Zirconium	do.	14.3

1/ Metallic minerals are contained metal.
2/ Includes the aluminosilicate sillimanite.
3/ Minerals Bureau estimates as of December 31, 1997.
4/ De Beers reserves and resource data only.
5/ Recoverable at a cost of less than $80 per kilogram.

Sources: Chamber of Mines Online Statistical Tables 1999 (URL http://www.bullion.org.za/bulza/publications/Stats/MinRes.pdf. Minerals Bureau estimates as of December 31, 1999. U.S. Energy Information Administration, United States-South Africa international energy data exchange, 1998 (URL http://www.eia.doe.gov/emeu/safricadata.htm). Petroleum and natural gas estimates as of January 1, 1999.

Digitized by Google

Digitized by Google

THE MINERAL INDUSTRY OF

SUDAN

By Thomas R. Yager

The mineral sector of Sudan has traditionally made a negligible contribution to the country's economy. The rising production of gold and crude petroleum in recent years, however, has substantially increased the mineral sector's influence on the national economy. Other mineral commodities produced in Sudan included asbestos, cement, chromite, gravel, gypsum, limestone, marble, mica, refined petroleum products, salt, and construction sand. Sudan was also known to have deposits of barite, copper, iron ore, kyanite, lead, nickel, silver, tungsten, wollastanite, and zinc.

In 2001, Sudan's gross domestic product (GDP) amounted to about $63.4 billion at purchasing power parity. The GDP at market exchange rates was $12.5 billion. Sudan's GDP increased by 5.3% in 2001 after rising by 9.7% in 2000, 7.7% in 1999, and 6% in 1998. In 1999, manufacturing and mining accounted for about 10% of the GDP; construction, 4%; and electricity and water, nearly 2% (International Monetary Fund, 2000, p. 4; 2002, p. 164; 2002a§[1], b§, c§).

The United Nations imposed sanctions on Sudan in 1996, and the United States, in November 1997. The sanctions, which were codified in 31 CFR part 538, prohibited investment by U.S. businesses in Sudan. In February 2000, the U.S. economic sanctions against Sudan were extended to the Greater Nile Petroleum Operating Co. (GNPOC) [a joint venture of China National Petroleum Corp. (CNPC), Petronas Carigali Overseas Shd. Bhd. of Malaysia, and Talisman Energy Inc. of Canada] and Sudapet Ltd. of Sudan, but not to the international corporate owners of GNPOC (U.S. Department of the Treasury, 2000).

In 2001, the U.S. House of Representatives passed the Sudan Peace Act, which would prohibit oil and gas companies that operate in Sudan from raising capital in or selling their shares within the United States. The version of the Sudan Peace Act passed by the Senate did not include these new sanctions. At the end of 2001, differences between the House and Senate bills had not been resolved (Indian Ocean Newsletter, 2001). The Sudan Peace Act resulted from the possible role of oil revenues in financing the civil war between the Government of Sudan and the Sudan People's Liberation Army (SPLA) as well as the allegations of atrocities and slavery associated with the war (Mobbs, 2002).

In 2000, Ariab Mining Company Ltd. (AMC) produced 5,770 kilograms (kg) of gold, which was an increase from 5,565 kg in 1999. Production in 2001 was estimated to be about 5,800 kg. The company mined gold at the Baderuk, the Hadal Auatib, and the Oderuk deposits. AMC's plant had the capacity to process 600,000 metric tons per year (t/yr) of ore. Gold was also produced by artisanal miners (Resource Information Unit, 2001).

Gold exports fell to 6,833 kg in 2001 from 8,452 kg in 2000 and 10,594 kg in 1999. Gold accounted for 7% of the value of Sudan's total exports in 1999 and less than 3% in 2001 (Bank of Sudan, undated b§, c§).

Sudan Master Technology (SMT) started operations at its steel plant in Giad Industrial City in July 1999. The plant had a meltshop with a capacity of 60,000 t/yr that produced billet for the 150,000-t/yr bar mill. From 1995 to 2000, Sudan's apparent consumption of finished steel rose to 111,000 metric tons (t) from 42,000 t (International Iron and Steel Institute, 2001, p. 91; Sudan Master Technology, undated§).

The production of cement declined by 47% from 1997 to 2000 owing to a lack of spare parts; the combined output of the Atbara and Rabak cement plants in 2000 was less than one-half the production capacity of the Atbara plant. Production at the Atbara plant fell to 105,500 t in 2000 from 224,600 t in 1997, and at Rabak, to 40,300 t from 51,000 t (Bank of Sudan, undated a§). Cement production was estimated to be 146,000 t in 2001.

Ingessana Hills Mines Corp., which was a state-owned company, operated Sudan's only chromite mine. Production fell to an estimated 20,500 t in 2001 from 28,500 t in 2000 and 48,000 t in 1999. The decrease in production was at least partially attributable to the decline in the global stainless steel market.

GNPOC produced most of Sudan's crude petroleum from the el-Toor, the Grand Heglig, the Tooma South, and the Unity oilfields. In 2001, GNPOC started production at the Bamboo, the Garaad, and the Khairat oilfields. Sudan's proved recoverable reserves of crude petroleum were estimated to be 563 million barrels; reserves of natural gas amounted to 85 billion cubic meters (Arab Petroleum Research Center, 2001; Radler, 2001; Oil & Gas Journal, 2002).

In May, the Government signed an exploration and production-sharing agreement with a consortium of companies to develop block 5B. Petronas Carigali Overseas of Malaysia held a 41% stake in the consortium; Lundin Petroleum AB, 24.5%; OMV Aktiengesellschaft of Austria, 24.5%; and National Petroleum Company of Sudan, 10%. Test drilling was expected to begin in 2002 (Middle East Economic Digest, 2001).

In November, Lundin Petroleum AB announced plans to invest at least $31.5 on its two concessions in blocks 5A and 5B in 2002. Lundin, however, withdrew its plans to acquire the 25% stake that Talisman held in GNPOC. At the end of 2001, the Government was negotiating production-sharing agreements with Rosneft Oil Company and Slavneft Oil and Gas Joint Stock Company (Africa Energy Intelligence, 2001c, d). Other companies that were exploring for petroleum in Sudan included al-Thani Petroleum of the United Arab Emirates, Gulf Petroleum Company of Qatar, and OMV Aktiengesellschaft of Austria.

[1]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

In 2001, exports of crude petroleum increased to 56.1 million barrels at a value of $1.27 billion from 49.5 million barrels at a value of $1.24 billion in 2000. Crude petroleum accounted for 35% of the value of Sudan's exports in 1999 and nearly 75% in 2001 (Sudan Central Bank, undated c§).

In June 2000, production started at the Khartoum Oil Refinery, which had a production capacity of 50,000 barrels per day (bbl/d). Gasoline from the Khartoum Oil Refinery was sent to Port Sudan for export. The 25,000-bbl/d Port Sudan plant accounted for a majority of Sudan's refinery output until 1999. The topping plants at Abu Jabra, El Obeid, and Sharjirah produced mainly heavy fuel oil. The Abu Jabra plant also produced diesel fuel and naphtha, and the El Obeid plant, kerosene, liquified petroleum gas, and naphtha (Arab Petroleum Research Center, 2001).

In 2001, the value of petroleum products exports amounted to $107.4 million, which was a decrease from $108.1 million in 2000. Exports of gasoline were $88.4 million; liquified petroleum gas, $18.6 million; and kerosene, $420,000. Exports of petroleum products amounted to about 6% of Sudan's total exports. In 2001, Ethiopia agreed to buy about 1 million barrels (Mbbl) of gasoline from Sudan (Africa Energy Intelligence, 2001b; Bank of Sudan, undated c§).

From 1995 to 1999, Sudan's consumption of petroleum products increased to about 11.7 Mbbl from 10.3 Mbbl. The consumption of gasoline increased to 2.1 Mbbl from 1.53 Mbbl, and diesel, to 6.5 Mbbl from 5.7 Mbbl. In 1999, about 66% of Sudan's demand for petroleum products was met through imports. The value of imported petroleum products increased to $163 million in 1999 from $80 million in 1995; falling volumes of imports were more than offset by rising prices. In 2000, the opening of the Khartoum Oil Refinery made Sudan self-sufficient for petroleum products except for jet fuel. Sudan was a net exporter of petroleum products in 2001 (International Monetary Fund, 2000, p. 11-12; Townsend, 2002; Bank of Sudan, undated d§).

At the end of 2001, Sudan's electrical generating capacity was 2,600 megawatts (MW). National Electricity Corporation (NEC) planned to increase capacity to 3,500 MW. In 2001, NEC started construction on the $1 billion Merowe Dam and signed a contract with the Malaysian company Ekitsas, the Polish company H. Cegielski SA, and the German comany Siemens AG to build a new 257-MW power station in Khartoum. Construction on the Merowe Dam was expected to start in early 2003 and last for 5½ years. The Abu Dhabi Development Fund, the Arab Fund for Economic and Social Development, the Kuwaiti Fund for Arab Economic Development, and the Saudi Industrial Development Fund planned to provide funding for the Merowe project. Other projects planned by NEC include hydroelectric plants at Shireik and Kgabar with capacities of 315 MW and 165 MW, respectively (Africa Energy Intelligence, 2002; Middle East Economic Digest, 2002).

In 1999, NEC produced 2,243 gigawatthours (GWh) of electricity, which was an increase from 2,160 GWh in 1998 and 1,864 GWh in 1995. From 1995 to 1999, NEC's consumption of diesel and other fuel oil increased to 315,000 t from 280,000 t. In 1999, industrial consumption of electricity amounted to 303 GWh, or 23% of Sudan's total power consumption (International Monetary Fund, 2000, p. 14).

In an agreement among the Governments of Djibouti, Ethiopia, and Sudan signed in 2001, the Ethiopian Electric Power Corporation pledged to start exporting electricity to Djibouti and Ethiopia by 2006. The cost of building the necessary transmission line was estimated to be $75 million (Africa Energy Intelligence, 2001a).

The outlook for Sudan's petroleum and gold industries depends heavily upon world market conditions for these commodities; most of the production of these commodities is exported. For Sudan's cement, gypsum, marble, and steel industries, the outlook depends upon the strength of the domestic economy.

In 2002, Sudan's production of crude petroleum was expected to reach 219,000 bbl/d. Plans to increase production to 290,000 bbl/d in 2003 and 450,000 bbl/d in 2005 could be disrupted by the civil war between the Government and the SPLA or by the 40 local tribal conflicts that plague the country. The world market for gold was expected to show little change in the near future. Modest decreases in mine production by 2003 were likely to be offset by falling demand (SG Securities Ltd., 2001, p. 22; Peel, 2002; Townsend, 2002).

The outlook for unexploited resources of barite, copper, iron ore, kyanite, lead, nickel, silver, tungsten, wollastanite, and zinc was for little change in the near future owing to civil unrest.

References Cited

Africa Energy Intelligence, 2001a, Legal issues—Ethiopia/Sudan—Oil cooperation pact signed: Africa Energy Intelligence, no. 301, June 20, p. 7.

Africa Energy Intelligence, 2001b, Legal issues—Sudan—Oil to win over IGAD: Africa Energy Intelligence, no. 303, July 18, p. 7.

Africa Energy Intelligence, 2001c, Legal issues—Sudan—Russian lobby moves into high gear: Africa Energy Intelligence, no. 312, December 12, p. 7.

Africa Energy Intelligence, 2001d, Lundin in investment drive: Africa Energy Intelligence, no. 312, December 12, p. 3.

Africa Energy Intelligence, 2002, NEC's expansion plan: Africa Energy Intelligence, no. 316, February 6, p. 3.

Arab Petroleum Research Center, 2001, Sudan, *in* Arab oil & gas directory: Paris, Arab Petroleum Research Center, p. 414-424.

Indian Ocean Newsletter, 2001, Sudan/United States—Decisive week for Sudan Peace Act: Indian Ocean Newsletter, no. 960, July 21, p. 2.

International Iron and Steel Institute, 2001, Steel statistical yearbook 2001: Brussels, International Iron and Steel Institute, 109 p.

International Monetary Fund, 2000, Sudan—Statistical appendix: Washington, DC, International Monetary Fund, July 17, 40 p.

International Monetary Fund, 2002, World economic outlook—Recoveries and recessions: Washington, DC, International Monetary Fund, April, 225 p.

Middle East Economic Digest, 2001, New Muglad Basin block awarded: Middle East Economic Digest, v. 45, no. 20, May 18, p. 10.

Middle East Economic Digest, 2002, Lahmeyer signs up for Merowe: Middle East Economic Digest, v. 46, no. 12, March 22, p. 18.

Mobbs, P.M., 2002, The mineral industry of Sudan, *in* Mineral industries of Africa: U.S. Geological Survey Minerals Yearbook 2000, v. III, p. 26.1-26.4.

Oil & Gas Journal, 2002, Sudan: Oil & Gas Journal, v. 100, no. 11, March 18, p. 51.

Peel, Quentin, 2002, Sudan's slow self-destruction: [London, United Kingdom] Financial Times, January 21, p. 11.

Radler, Marilyn, 2001, World crude, gas reserves expand as production shrinks: Oil & Gas Journal, v. 99, no. 52, December 24, p. 125-127.

Resource Information Unit, 2001, Sudan, *in* Register of African mining 2001/02: Subiaco, Australia, Resource Information Unit, p. 275-276.

SG Securities Ltd., 2001, Quarterly metals review—A mountain to climb: London, United Kingdom, SG Securities Ltd., October, 28 p.

Digitized by Google

Townsend, David, 2002, Oil, not war: Petroleum Economist, v. 69, no. 3, March, p. 26-27.
U.S. Department of the Treasury, 2000, Treasury applies Sudan sanctions to joint oil venture: Washington, DC, U.S. Department of the Treasury press release, February 16, 1 p.

Internet References Cited

Bank of Sudan, [undated]a, Agricultural and industrial production, Annual Report 2000, accessed May 16, 2002, at URL http://www.bankofsudan.org/annual00e/chap6e00.htm.
Bank of Sudan, [undated]b, Foreign trade, Annual Report 2000, accessed May 16, 2002, at URL http://www.bankofsudan.org/annual00e/chap7e00.htm.
Bank of Sudan, [undated]c, Exports by commodity during 2000-2001, Foreign Trade Statistical Digest, accessed May 16, 2002, at URL http://www.bankofsudan.org/digeste/exports/TAB_4a.htm.
Bank of Sudan, [undated]d, Imports by commodity during the period Jan.-Dec. 2001, Foreign Trade Statistical Digest, accessed June 20, 2002, at URL http://www.bankofsudan.org/digeste/imports/TAB_4b.htm.
International Monetary Fund, 2002a, Selected world aggregates, World Economic Outlook Database, accessed April 23, 2002, at URL http://www.imf.org/external/pubs/ft/weo/2002/01/data/w1.csv.
International Monetary Fund, 2002b, Shares of aggregate GDP based on purchasing power parity (PPP) valuation of country GDP—Developing countries, World Economic Outlook Database, accessed April 23, 2002, at URL http://www.imf.org/external/pubs/ft/weo/2002/01/data/ppp_a.csv.
International Monetary Fund, 2002c, Shares of aggregate GDP based on purchasing power parity (PPP) valuation of country GDP—Developing countries, World Economic Outlook Database, accessed June 10, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/01/data.
Sudan Master Technology, [undated], Steel plant, accessed May 24, 2002, at URL http://www.sudanmaster.com.

TABLE 1
SUDAN: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000	2001 e/
Cement, hydraulic		275,600 r/	197,800 r/	230,600 r/	145,800 r/	146,000
Chromite, mine output, gross weight e/ 3/		30,500	30,500 r/	48,000 r/	28,500 r/	20,500
Gold, mine output, Au content 4/	kilograms	4,554	5,653	5,565 r/	5,770 r/	5,800
Gypsum e/		4,000	3,000	4,000	4,000	4,000
Petroleum:						
Crude (including lease condensate)	thousand 42-gallon barrels	2,000 e/	1,200 e/	17,120 r/	67,152 r/	77,755 5/
Refinery products e/	do.	4,900 r/	6,000	8,000	15,000	18,000
Salt		50,000 e/	72,211 r/	117,148 r/	120,000 r/ e/	120,000

e/ Estimated; estimated data are rounded to no more than three significant digits. r/ Revised.
1/ Includes data available through August 30, 2002.
2/ In addition to the commodities listed, the following are presumably produced although available information is inadequate to estimate output: clay and/or shale for cement manufacture (normally about 0.4 metric ton of clay and/or shale per metric ton of finished cement); limestone for cement manufacture (normally limestone for cement manufacture (normally at least 1.25 metric ton per metric ton of finished cement), agriculture, lime manufacture, and construction aggregate and fill; and other construction materials (clays, sand and gravel, stone, and others for local use and marble for export).
3/ Presumed to be ores and concentrates with an estimated average grade of about 48% chromic oxide.
4/ Does not include artisanal output.
5/ Reported figure.

Digitized by Google

TABLE 2
SUDAN: STRUCTURE OF THE MINERALS INDUSTRY IN 2001

(Metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Atbara Cement Company Ltd. (La Farge Group of France and Dal Group of Sudan)	Atbara	360,000.
Do.	Nile Cement Company (Government, 100%)	Rabak	150,000.
Chromite	Advanced Mining Works Co. Ltd.	Ingessana Hills	48,000.
Gold kilograms	Compagnie Miniere Or (Government, 60%; Ariab Mining Company, 40%)	Ariab	6,100.
Gypsum	Sudanese Mining Corp. (Government, 100%)	Bir Eit Mine	15,000.
Limestone	Atbara Cement Company Ltd.	Atbara	500,000.
Do.	Nile Cement Company	Rabak	200,000.
Marble	Pentco Engineering & Trading Company	Port Sudan and Gedaref	100,000.
Mica	Sudanese Mining Corp. (Government, 100%)	Sheriek Mines	1,800.
Petroleum:			
Crude thousand barrels	Greater Nile Petroleum Operating Co. [China National Petroleum Corp. (CNPC), 40%; Petronas Carigali Overseas Shd. Bhd., 30%; Talisman Energy Inc., 25%; National Petroleum Co. of Sudan (Sudapet), 5%]	Block 1 (Unity, El Toor, and Tooma South Fields), block 1a (Munga and Khairat Fields), block 2 [Grand Heglig Field (Barki, Hamra, Heglig, Kanga Laloba, Rihan, and Toma Fields)], and block 2a (Bamboo and Garaad Fields)	80,300.
Do. do.	Golf Petroleum (Sudan) Ltd. (Qatar Petroleum Co., 60%; Concorp International of Sweden, 20%; Sudapet, 20%)	Block 3 (Adar-Yale field)	1,825.
Do. do.	CNPC	Block 6 (Abu Gabra, Sharaf, and Tabaldi Fields)	730.
Refined do.	Khartoum Oil Refinery	Jali	1,515 liquified petroleum gas, 7,428 gasoline, 1,569 kerosene, and 7,738 diesel fuel.
Do. do.	Port Sudan Refining Ltd. (Government, 100%)	Port Sudan	93 liquified petroleum gas, 1,014 gasoline, 898 kerosene, 2,499 diesel fuel, 4,154 residual fuel oil, and 458 naptha.
Do. do.	Government	El Obeid	3,650.
Do. do.	Concorp Ltd.	Shajirah	3,650.
Do. do.	Government	Abu Jabra	730.
Steel:			
Crude	Sudan Master Technology	Giad Industrial City	60,000.
Rebar	do.	do.	150,000.

Digitized by Google

THE MINERAL INDUSTRY OF

SWAZILAND

By George J. Coakley

The Kingdom of Swaziland is a landlocked country surrounded by South Africa on three sides and by Mozambique to the east, has a surface area of 17,360 square kilometers, and supported a population of about 1 million people in 2001. Mining has been an important part of the history of Swaziland but a small and declining factor in its present economy. Swaziland contains the world's oldest known mine site, the Lion Cavern at the Ngwenya iron mine (closed in 1977) on Bomvu Ridge northwest of Mbabane. Carbon-14 dating yielded an estimate for the earliest mining at this site of from 43,000 to 41,000 B.C. The material extracted was hematite (libomvu) and specularite ochres for cosmetic and ritual uses. These ores could have been mined until at least 23,000 B.C. (Swaziland National Trust Commission, undated§[1]).

Asbestos, coal, and crushed stone were the country's main mining products (table 1). Diamond mining, which was all from a single kimberlite pipe at Dvokolwako, ceased in 1996, and asbestos mining ceased in 2000. Small-scale gold mining has taken place in the past within Swaziland's portion of the Barberton greenstone belt; but official gold production has been nil. Swaziland also has intermittent production of brick clay for a brick mill near Matsapha.

The country's gross domestic product (GDP) in 2000 (the latest year for which data were available) was estimated to be $4.4 billion based on purchasing power parity; this represents a growth rate of 2.4%. The GDP per capita was $4,000 (U.S. Central Intelligence Agency, 2002§). The Swazi economy was dominated largely by export-oriented agricultural and related value-added manufacturing production, which was vulnerable to climatic and external demand factors. In the Governmental fiscal year 2000-01, mining and quarrying generated revenues of about $11.4 million,[2] equal to 1.4% of the Kingdom's real GDP, a decline from $19.4 million and 1.6%, respectively, in the previous year. The decline was attributed to the 31.5% decrease in the value of asbestos production and the 11.3% decrease in the value of coal production, resulting from lower tonnages, from that of fiscal year 1999-2000. As a result of declining reserves, environmental concerns, and weak markets, asbestos mining, which had been the dominate source of mining revenue, ceased by yearend 2000. Mining and quarrying revenues for fiscal year 2000-01 comprised coal ($6.85 million), asbestos ($3.01 million), and crushed stone ($1.59 million) (Central Bank of Swaziland, 2002§).

In 2001, fewer than 1,000 Swazis were directly employed in the country's mining sector, although an estimated 1,000 Swazis processed timber from the country's extensive pine plantations that was exported to mines in South Africa, and 10,000 to 15,000 Swazis were employed in South African mines. Wage repatriation from miners in South Africa contributed to the Swazi economy; the collapse of international gold prices and subsequent downsizing of the South African gold mining labor force, however, resulted in layoffs of a number of Swazi miners and reduction in miner wage remittances back to Swaziland. Swaziland Greenstone Quarry, which was a Taiwanese company, was examining the potential for developing a green chert operation in the Malolotja Game Reserve in the Hhohho region but faced environmental opposition from the Swaziland National Trust Commission (Michael Lee Enterprises, 2002§).

Foreign investment in mining remained regulated by the Investment Promotion Bill of 1997. The legislation, which is part of the Swazi economic and social reform agenda, was developed to promote local and foreign investment in Swaziland. The Swaziland Investment Promotion Authority, which is a one-stop service center for investors, opened in 1999. In October 2000, the Government announced new tax incentives to attract new foreign investment. The new provisions included a 10-year cut in corporate tax to 10% from 37.5% for eligible "development" companies and a 10-year exemption from withholding tax on dividends. MBendi Information Services (Pty) Ltd. (2000§) described Swaziland's minerals policy and legislation as follows: "There is a fundamental distinction in the constitutional law of Swaziland between the State and its Government on the one hand and on the other the 'Swazi Nation' and the King (the Ngwenyama). By constitution minerals are vested in the Ngwenyama in trust for the Swazi Nation. The Ngwenyama grants mineral rights after consultation with a Minerals Committee. This committee is appointed by the Ngwenyama on advice by his advisors in accordance with the Swazi law and custom. The conditions and terms of mineral rights issued are negotiated and approved by the Ngwenyama."

Commodity Review

Asbestos.—In fiscal year 2000-01, production of chrysotile asbestos from the Bulembe Mine, which was one of the world's largest asbestos mines, decreased by 45% from fiscal year 1999-2000. The mine, which once employed about 1,000 workers, was closed in 2000. Following similar actions by South African asbestos miners, a group of 450 former asbestos miners in Swaziland who were suffering from asbestos-related lung disease announced in September 2000 plans to file a suit against the British firm Turner & Newall Ltd., which operated the asbestos mine in northwestern Swaziland through the early 1980s. The South African case against Turner & Newall was

[1]References that include a section twist (§) are found in the Internet References Cited section.

[2]Where necessary, values have been converted from Swazi emalangeni (E) to U.S. dollars at the rate of E7.1=US$1.00 for 2000 and E6.11=US$1.00 for 1999.

Digitized by Google

settled in favor of the South African asbestos miners in April 2002 for more than $30 million. The separate case for Swazi asbestos miners, however, was still pending (Temkin, 2002§).

Coal.—Production from the Maloma Mine, which was the sole coal producer, declined by 11.3% to 378,043 metric tons (t) in fiscal year 2000-01 from 426,299 t in fiscal year 1999-2000. The mine, which switched from open pit to underground operations in 1999, produced high-quality anthracite for export to South Africa. Following a methane gas explosion in July 2001, which killed 1 worker and injured 12 others, the mine was closed. The mine had sufficient resources to sustain production for the next 25 years, but whether it would reopen was uncertain (Mabuza, 2001§; Swaziland Business Yearbook, 2002§).

Stone, Crushed.—Stimulated by ongoing activity for road building and rehabilitation, the production of crushed stone increased by 21.5% to 304,043 t in fiscal year 2000-01 from 250,193 t in fiscal year 1999-2000. Main construction projects included the Nhlangano-Lavumisa and Ngwenya-Mbabane highways, the Siteki-Mhlumeni road, continued work on the Mbabane-Manzini highway, and the Maguga Dam.

Outlook

With the closure of the principal asbestos and coal mines and the cutback in the employment of Swazi migrant workers in South Africa gold mines, the mineral sector of the Swazi economy has essentially collapsed. The main hope for revival of this sector rests with the ability of the Government to attract new foreign investment to reopen one or all the closed coal mines at Maloma and Mpaka where identified coal resources could support additional production. As an energy source in the region, however, Swazi coal is faced with competition from excess coal capacity in South Africa and the development of low-cost natural gas resources in Mozambique.

Internet References Cited

Central Bank of Swaziland, 2002, Annual report for the financial year 2000-2001, accessed July 5, 2002, at URL http://www.centralbank.sz/report2001/ar2001_11.html.

Mabuza, Fanyana, 2001 (July 16), Mine blast kills one, injures 12, Africa Eye News Service (Nelspruit, South Africa), accessed July 9, 2002, at URL http://allafrica.com/stories/200107160668.html.

MBendi Information Services (Pty) Ltd., 2000 (October 23), Swaziland—Mining, accessed July 2, 2002, at URL http://www.mbendi.co.za/indy/ming/af/sw/ p0005.htm.

Michael Lee Enterprises, 2002, Comments on the proposed greenstone quarry—Malolotja Nature Reserve, Swaziland, accessed July 6, 2002, at URL http://ecs.co.sz/malolotja_mlecomments.htm.

Swaziland Business Yearbook, 2002, Geology and mining, accessed July 9, 2002, at URL http://www.swazibusiness.com/sbyb/geo.html.

Swaziland National Trust Commission, [undated], Mines of Malolotja—Iron mines, accessed April 1, 2001, at URL http://www.sntc.org.sz/cultural/ironmine.html.

Temkin, Sanchia, 2002 (April 23), Justice sought for workers suffering from asbestosis, Business Day Online (South Africa), accessed July 6, 2002, at URL http://www.bday.co.za/bday/content/direct/1,3523,1069304-6078-0,00.html.

U.S. Central Intelligence Agency, 2002, Swaziland—Economy, World Factbook, accessed July 3, 2002, at URL http://www.odci.gov/cia/publications/factbook/index.html.

Major Sources of Information

Ministry of Natural Resources and Energy
P.O. Box 57
Mbabane, Swaziland
Telephone: (268) 46-244
Fax: (268) 42-436

Geological Survey and Mines Department
P.O. Box 9
Mbabane, Swaziland
Telephone: (268) 42-411
Fax: (268) 45-215

TABLE 1
SWAZILAND: PRODUCTION OF MINERAL COMMODITIES 1/

Commodity 2/		1997	1998	1999	2000	2001 e/
Asbestos, chrysotile fiber	metric tons	25,888	27,693	22,912 r/	12,690	--
Coal, anthracite	thousand metric tons	203	410	426	378	380
Stone, quarry products	thousand cubic meters	456	453	250	304	350

e/ Estimated. r/ Revised. -- Zero.

1/ Reported data from Swaziland Geological Survey and Mines Department or Central Bank. Includes fiscal year data available through July 2002.

2/ In addition to the commodities listed, modest quantities of crude construction materials (brick clay and sand and gravel) and pyrophyllite are produced, but output is not reported quantitatively, and information is inadequate to make reliable estimates of output levels.

Digitized by Google

THE MINERAL INDUSTRY OF

TANZANIA

By Thomas R. Yager

In recent years, the mineral industry of Tanzania has produced gold, iron ore, and steel, such industrial minerals as bentonite, kaolin and other clays, calcite, diamond and other gemstones, graphite, gypsum, phosphate rock, salt, silica sand, and soda ash. The country has also produced coal, petroleum products, and such building materials as cement, gravel, limestone, and sand. Deposits of cobalt, copper, natural gas, nickel, and titanium are also known to occur in Tanzania.

In 2001, Tanzania's gross domestic product (GDP) at purchasing power parity amounted to $22.3 billion. Per capita GDP at purchasing power parity was about $650. The GDP at market exchange rates amounted to $9.1 billion. The GDP grew by 5.6% in 2001, compared with 5.1% in 2000, 3.5% in 1999, and 3.7% in 1998. Manufacturing accounted for 7.7% of GDP; construction, 3.6%; mining and quarrying, 2.3%; and electricity and water, 1.7% (International Monetary Fund, 2002, p. 174; 2003, p. 101; 2002a§[1]-c§). After increasing by 13.9% in 2000 and 9.1% in 1999, the value of output in the mining sector rose by 13.5% in 2001. From 1996 to 2001, the value of output in the mining sector grew by an average of 16% per year owing to substantial increases in diamond and gold production (table 1). During the same period, the value of output in the construction and electricity sectors increased by an average of 9.5% and 4.1%, respectively (International Monetary Fund, 2003, p. 101).

Trade

Tanzania's mineral exports have increased substantially from 1998 to 2001. Most of the increase was attributable to gold exports, which increased to $262.6 million in 2001 from $3.34 million in 1998. During the same period, diamond exports increased to $30.55 million from $12.11 million, and gemstone exports, to $18.76 million from $8.13 million. From 1998 to 2001, exports of tanzanite totaled $48 million. The share of total exports attributable to minerals increased to 40% in 2001 from 27% in 2000; the share of total exports attributable to gold increased to 33% from 18% (Africa Mining Intelligence, 2001a; Mchihiyo, 2001, 2002; S.S. Salim, Tanzanian Ministry of Energy and Minerals, written commun., 2002).

The International Monetary Fund (2003, p. 127) reported that imports of fertilizers amounted to $15.5 million in 2001, which was a decrease from $16.8 million in 2000 and $23.3 million in 1996. Tanzania imported $220.7 million of petroleum products in 2001, which was an increase from $142.6 million in 2000 and $158.4 million in 1996.

[1]References that include a section twist (§) are found in the Internet References Cited section.

Commodity Review

Metals

Cobalt, Copper, and Nickel.—Barrick Gold Corp. was conducting a feasibility study on mining the Kabanga nickel sulfide deposits in northwestern Tanzania. In 2001, Barrick announced that it had discovered a new ore body at Kabanga that increased contained nickel resources to 600,000 metric tons (t) from about 400,000 t. Kabanga also had resources of cobalt and copper. In 2002, Barrick planned to increase resources to 1 million metric tons (Mt) of contained nickel. Previous owner Sutton Resources Ltd. had planned to produce about 17,000 metric tons per year (t/yr) of nickel, 1,600 t/yr of copper, and 1,200 t/yr of cobalt (Jones, 1999; Barrick Gold Corp., 2002b, p. 37).

In 2001, Barrick's Bulyanhulu gold mine produced 20,221 t of gold-copper concentrates that contained most of the 2,645 t of domestic copper output (table 1); these concentrates were exported to Japan for smelting. Small amounts of copper were also contained in the gold doré produced at Bulyanhulu. In 2002, Barrick expected a copper recovery rate of 88%; gold-copper concentrate production was expected to be 20,685 t (Barrick Gold Corp., 2002a, p. 71).

Goldstream Mining NL of Australia explored for cobalt, copper, and nickel at the Mibango Project near Lake Tanganyika and at the Luwumbu Project near Lake Malawi. The company also explored for copper and nickel at Mbozi and for nickel at Mwahanza. In 2001, Goldstream withdrew from the Rukwa property, where it had explored for copper, gold, iron ore, and lead. Goldstream planned exploration work on projects in areas south of Mibango in 2002 (African Mining, 2001c; Goldstream Mining NL, 2001, p. 5-6).

Gold.—In 2001, Tanzania's gold production increased to about 30,088 kilograms (kg) from 15,060 kg in 2000 and 4,767 kg in 1999. Tanzania became the fourth largest gold producer in Africa in 2001. The Bulyanhulu, Geita, and Golden Pride Mines had the capacity to produce about 33,600 kilograms per year (kg/yr) of gold. Tanzania's resources amounted to about 1,300 t of contained gold, of which more than 700 t was reserves (tables 1-3).

In 2001, the Geita open pit gold mine produced 16,969 kg of gold from 4.52 Mt of ore, compared with 5,500 kg of gold from 2.08 Mt of ore in 2000. Geita Gold Mines [owned by Anglogold Ltd. (50%) and Ashanti Goldfields Co. Ltd. (50%)] started production in 2000. The gold recovery rate increased to 93% in 2001 from 92% in 2000, and the operating cash cost fell

Digitized by Google

to $143 per troy ounce from $145 per ounce (Ashanti Goldfields Co. Ltd., 2002, p. 14).

In 2001, only the Nyankanga and Lone Cone pits were being mined; production was expected to start at Kukuluma in the first quarter of 2002. Geita Gold Mines increased open pit reserves at Nyankanga and started a full feasibility study on mining the Nyankanga underground resources. The company conducted drilling at several locations on the Geita minesite, which includes Chipaka and Geita Hill. Anglo and Ashanti agreed to explore and develop jointly properties in Tanzania contributed by either company. Geita Gold Mines was also planning a feasibility study on expanding plant capacity to 7 Mt/yr of ore from 4 Mt/yr (Resource Information Unit, 2001, p. 285; Ashanti Goldfields Ltd., 2002, p. 14).

Geita was on the outer arc of the greenstone belts south of Lake Victoria where the gold mineralization is associated with banded ironstone formations. The inner and outer arcs are separated by Archean basement rocks and intrusive granites. Unlike the Bulyanhulu Mine, Geita has little associated copper or silver mineralization. Nyankanga has the largest tonnage and the highest grade of the deposits at the Geita Mine; it is hosted in banded ironstones and diorite intrusive rocks. The ore at Nyankanga has a low sulfide content and was nonrefractory, which contributes to higher rates of recovery. The ore at Kukuluma is refractory, which contributes to a primary ore recovery rate of only 66%.

In 2001, the Golden Pride open pit mine, which was owned by Resolute Mining Ltd., produced 5,289 kg of gold from 1.84 Mt of ore milled at an average grade of 3.11 grams per metric ton (g/t). Production fell during 2001 because of lower head grades and the grindability characteristics of the ore. As part of its planned increase in plant capacity, Resolute purchased a new ball mill to resolve these issues. Resolute planned to increase the rated capacity of its processing plant to more than 3 Mt/yr from 1.65 Mt/yr. The upgrade was expected to cost $10.6 million and be completed by September 2002 (Resolute Mining Ltd., 2001b, 2002).

At the end of 2001, Resolute had increased its reserves to 13.77 Mt at a grade of 2.53 g/t gold from 5.8 Mt at a grade of 2.91 g/t gold. In June 2001, resources were reported to be 28.66 Mt at a grade of about 2.4 g/t gold (table 3). The increase in reserves at Golden Pride was expected to extend the life of the mine from 2004 to at least 2008 (African Mining, 2001b; Resolute Mining, 2001a, p. 19).

Kahama Mining Corp. Ltd. (KMC) (100% owned by Barrick) operated the Bulyanhulu underground gold mine, which started production in March 2001. Output amounted to 7,514 kg of gold from 705,738 t of ore; KMC also produced copper and silver as coproducts. In 2001, the average recovery rate for gold was 82%; recovery rates increased in the fourth quarter (Barrick Gold Corp., 2002a, p. 69, 71). The majority of gold was recovered from copper concentrates; the remainder was from gold doré.

In 2002, Barrick expected to recover 57% of the gold mined from copper concentrates and 32% from gold doré for an overall recovery rate of 89%. Gold recovery rates would be lower than those at Geita because of the complex metallurgy of the ore. Barrick expected to increase production to nearly 11,300 kg from 1.02 Mt of ore in 2002 and to 14,000 kg in 2004 and 2005; capacity would increase to 15,500 kg/yr from 12,400 kg/yr. Cash operating costs were expected to fall to $173 per ounce of gold in 2002 from $197 per ounce of gold in 2001 (Barrick Gold Corp., 2002a, p. 69, 71).

The Bulyanhulu deposit was located on the inner arc of the greenstone belts south of Lake Victoria. The inner arc, which did not have the banded iron formations found at Geita, was characterized by intermediate to mafic volcanic rocks, felsic pyroclastics, and a quartz-porphyry intrusive. Reef 1, which was being mined in 2001, had most of the mine's reserves; it is hosted in 2.5-meters (m)-to-10-m-wide black argillite between a footwall basalt and a hanging wall felsic pyroclastic ash associated with a quartz-vein system. Reef 0 also had reserves of gold; it is also associated with a quartz vein system. Reef 2, which was not as well-defined a zone of mineralization, is contained in basalt. The Bulyanhulu trend dips 75 to 80 degrees to the northeast and is open to 2000 m. The footwall basalt shows carbonate and sericitic alteration. Gold mineralization occurs as electrum and is enclosed in pyrite.

In 2000, Barrick acquired 100% ownership of the Golden Ridge project near the Bulyanhulu Mine. In spite of the proximity to Bulyanhulu and substantial resources of gold, Barrick had Golden Ridge on hold in 2001; the Tulawaka project had a smaller amount of contained gold, but the gold is a high grade (table 3). Tulawaka was a joint venture with Explorations Minieres du Nord Ltee of Canada. Barrick spent $3 million upon exploration at Tulawaka in 2001 and planned to spend an additional $3 million in 2002. The company expected to finish a development plan for Tulawaka in the second half of 2002. Minieres du Nord completed a resource assessment of Tulawaka in 2001 (African Mining Bulletin, 2001c; Resource Information Unit, 2001, p. 286-287; Barrick Gold Corp., 2002a, p. 68).

In 2001, Barrick also explored at the Baker and the Chocolate Reef properties near the Golden Pride Mine and at the Musoma area on the shore of Lake Victoria. Barrick held 26 licenses in the Sekenke district and 18 licenses near the Geita Mine. The company planned further exploration work at the Kirondatal property in the Sekenke district in 2002. Barrick expected to increase its total gold exploration spending in Tanzania to $5 million in 2002 from $4 million in 2001 (Resource Information Unit, 2001, p. 285-286, 296, 299; Barrick Gold Corp., 2002a, p. 76-77).

East African Gold Mines Ltd. (EAGM) announced plans to start production at the North Mara open pit gold mine in September 2002. The North Mara project encompassed the Nyabigena and the Nyabirama gold deposits; the development of Nyabirama would precede that of Nyabigena. EAGM expected North Mara to produce 2 Mt/yr of ore and about 5,300 kg/yr of gold. The mine was expected to have a life of 10 years with operating costs of $200 per ounce and a gold recovery rate of 90%. EAGM also held an exploration area of 450 square kilometers (km^2) that surrounded the mine properties; the company planned future exploration after securing a cash flow from North Mara (Lion Selection Group Ltd., 2002, p. 17).

Artisanal gold miners were known to operate in numerous locations in Tanzania; these included near Geita, Miyabi, and

Digitized by Google

North Mara. Meremeta Ltd. bought gold from small-scale miners and rented out mining and processing equipment to the miners. The company also held a 70% interest in the Buhemba prospecting license, which included the Buhemba, Buhemba South, Kilamongo, Magunga, and Mwizi deposits. In 2001, the Government invited International Gold Exploration AB (IGE) of Sweden to assist in the establishment of small- scale gold mining and processing operations. IGE might also have opportunities to form joint ventures with major mining companies to explore for larger gold deposits (African Mining Bulletin, 2001b; Resource Information Unit, 2001, p. 281-282).

Spinifex Gold Ltd. held the licenses to the Buckreef/ Rwamagaza, Kitongo, and Nyakafuru deposits, which had combined resources of nearly 57 t (1.8 million troy ounces) of contained gold (table 3). In 2001, a scoping study indicated that resources at these deposits had to be increased to reduce operating costs. Throughput rates of 500,000 t/yr of sulfide ore and 800,000 t/yr of oxide ore would be needed for economies of scale. Spinifex was searching for joint-venture partners to develop Buckreef, Kitongo, and Nyakafuru and was considering infill drilling on the three projects. The company also held licenses at Ikina Reefs, Maji Moto, and Nyang'ombe (Lion Selection Group, 2001, p. 20-21; Resource Information Unit, 2001, p. 294, 298).

In 2001, Twigg Minerals plc engaged in drilling and established a resource of 2.06 Mt at a grade of 2.12 g/t gold at its Miyabi property (table 3). Twigg also explored its Kakumbi, Msasa/Ikuzi, and Nikonga properties and acquired the Mwabomba and Zanzui licenses. The company planned to conduct pitting and drilling at Kakumbi and to drop the Mulehe and Nyamirembe properties in 2002 (Twigg Minerals plc, 2002, p. 2-5).

Sub-Sahara Resources NL of Australia (formerly known as Maiden Gold NL) explored for gold at the Jubilee Reefs, Mwagi Magi, and Nyanzaga projects. In May 2001, the company took over Universal Gold NL and acquired the Bukome, Kahama, Mabale Hills, Ngula, and Nyamirembe Projects. Sub-Sahara also acquired a 35% share in Ikina Reefs Ltd., which held the Ikina Reefs prospecting license. By August, Anglovaal Mining Ltd. had terminated its joint venture with Sub-Sahara for Jubilee Reefs, Mwagi Magi, and Nyanzaga. Sub-Sahara sought new joint-venture partners for these projects as well as for the Musoma Mara and South Siga Hills Projects (Sub-Sahara Resources NL, 2001, p. 5, 7, 9- 11).

In 2001, Tan Range Exploration Corp. explored at the Itetemia concession; the company focused its efforts upon the Golden Horseshoe Reef. Exploration work at the Luhala concession, which included the Kisunge Hill deposit (table 3), focused upon the Shilalo South Hill area. The company also held the Kabahelele property. Tan Range wrote off the Geita East property after completing a drilling program that started in August 2000 (Resource Information Unit, 2001, p. 285, 288-289, 292).

By March 2001, Lakota Resources Inc. of Canada held 40 properties in Tanzania; these included Busohgo, Bukombe, Mwamba, Ngula, and Siga Hills. Lakota planned preliminary exploration activities for some of the licenses. Tanzanian American International Development Corp. (Tanzam) held 100% ownership of 10 licenses and joint ventures in 41 licenses. In early 2001, Tanzam started exploration work on some licenses. Goldstream Mining explored for gold at the Manyawa and Tarani prospects near the Buhemba deposit (Resource Information Unit, 2001, p. 281, 291, 292).

Renewable Energy Corp. Ltd. of Australia explored for gold at the Buhingo, Bwenda River, Gilya, Imerwu, Kiabakari SW, Lupa, Maji Moto, Mawe Meru, Ngasamo, Nyawa, Samena I, Samena II, and Wamangola licenses. In mid-2000, the company put these properties up for sale and focused on its waste disposal business (Resource Information Unit, 2001, p. 282-283, 285, 291, 293- 294, 296-297, 300).

Conquest Resources Ltd. held the Ikungu license, which included the Forest Reef and the Phoenix deposits, and the Suguti license. Mincor Resources NL held the Imweru property, which was 50 kilometers (km) west of the Geita Mine. The company relinquished its interest in the Kianyari, Nyasiori, and Suguti licenses in December 2000 (Resource Information Unit, 2001, p. 281, 287, 299-300).

Iron and Steel.—Tanzania produced iron ore from the Itewe deposit near Chunya until 1997. Other iron ore deposits were found at Liganga and the Uluguru Mountains. The state-owned National Development Corp. (NDC) was seeking investors to help develop the Liganga deposit. Goldstream Mining was exploring for iron ore at Mwahanza (African Mining, 2001c).

From 1996 to 2001, Tanzania's production of steel increased to 16,100 t from 4,800 t (table 1). In 2000, SITA Rollings Ltd. operated a plant that produced about 3,600 t of cold-rolled steel products. About 10% of the company's sales was exports. SITA planned to increase production to the plant's capacity of 14,000 t/yr. Aluminum Africa Ltd. (ALAF) operated a plant for galvanizing sheet steel. Jeje Industries planned to set up a plant for galvanizing sheet steel with a capacity of 30,000 t/yr; the cost of the plant was estimated to be $2.5 million (United Nations Industrial Development Organization, 2000a, b; International Monetary Fund, 2003, p. 106). Other companies operated small rolling mills that produced rebar.

The International Iron and Steel Institute (2001, p. 81, 85) estimated that Tanzania's imports of semimanufactured and finished steel products amounted to 69,000 t in 2000; this was a decrease from 93,000 t in 1999 and an increase from 56,000 t in 1995. From 1995 to 2000, Tanzania's apparent consumption of crude steel rose to 77,000 t from 63,000 t.

Lead and Zinc.—Imports of refined zinc increased to 4,570 t in 2001 from 3,848 t in 2000 and 2,447 t in 1998. Zinc was consumed by ALAF for galvanizing sheet steel. Goldstream Mining explored for lead and zinc at Nachingwea in southeastern Tanzania and Wansisi near Lake Victoria (African Mining, 2001c; British Geological Survey, written commun., 2002).

Platinum-Group Metals.—In 2001, Goldstream Mining explored for platinum-group metals (PGMs) at the Mibango Project near Lake Tanganyika and at the Luwumbu Project near Lake Malawi. Other PGM exploration projects included the Mbozi and Wansisi. Goldstream Mining planned exploration

Digitized by Google

work on projects in areas south of Mibango in 2002. Other companies that held prospecting licences for PGMs included Nyati Mining and Tumbili Ventures (African Mining, 2001c; Goldstream Mining NL, 2001, p. 5-6; Mchihiyo, 2001).

Silver.—Tanzania produced silver as a coproduct of gold mining and refining. Domestic output of silver increased to 6,861 t in 2001 from 1,384 t in 2000 and 276 t in 1999 (table 1). In 2001, the Bulyanhulu Mine produced 20,221 t of copper concentrates that graded 270 g/t silver. The silver content of the gold doré produced at Bulyanhulu was about 35%. In 2002, Barrick expected a recovery rate of 65% for silver. Goldstream Mining explored for silver at Nachingwea in southeastern Tanzania (African Mining, 2001a, c; Barrick Gold Corp, 2002a, p. 71).

Titanium, Vanadium, and Zirconium.—Deposits of heavy-mineral sands, which contain ilmenite, rutile, and zircon, were found at Bagamoyo and Msimbati. Meremeta Ltd. held a license for a heavy-mineral sands project (Resource Information Unit, 2001, p. 282). NDC's investment promotion plans for the Liganga iron ore deposit included the possibility of producing titanium and vanadium concentrates.

Industrial Minerals

Cement.—In 2001, Tanzania's consumption of cement was estimated to be about 800,000 t/yr, which was an increase of nearly 6% from 2000. The majority of cement consumption was attributable to the housing sector, especially concrete block manufacturers (International Cement Review, 2001, p. 286; Holcim Ltd., 2002, p. 36). The backfill operation for the Bulyanhulu underground gold mine consumed about 25,000 t/yr of cement. From 1996 to 2001, Tanzania's production of cement increased to 900,000 t from 725,800 t because of gold mine development, infrastructure works, and large construction projects. Tanzania's three cement producers were Mbeya Cement Co. Ltd., Tanga Cement Co. Ltd., and Tanzanian Portland Cement Co. Ltd. (TPCC), which had a total clinker grinding capacity of 1.25 Mt/yr and a total cement production capacity of 1.55 Mt/yr (table 2). In recent years, cement has been exported to Burundi, Comoros, Rwanda, and Uganda (International Cement Review, 2001, p. 286; International Monetary Fund, 2003, p. 106).

Diamond.—Production at the Williamson Mine fell in 2001; diamond recovery fell to 190,634 carats from 286,124 carats in 2000. The decrease in diamond output was mostly attributable to a lower head grade. Ore treated fell to 2.87 Mt at a grade of 6.7 carats per 100 t from 2.96 Mt at a grade of 9.7 carats per 100 t (DeBeers Group, 2002, p. 35). The mine's entire diamond output was exported to the United Kingdom.

DeBeers Group was constructing a new processing plant that would increase the mine's ore treatment capacity to 5 Mt in 2002 and 6.5 Mt/yr in 2003 and subsequent years. The plant would process only tailings and use new technology to alleviate problems with high electricity and ferrosilicon costs. Production was expected to start at the new processing plant in June 2002.

DeBeers was also conducting further exploration at the mine site. Reworked volcanoclastic kimberlite ore graded about 6.5 carats per 100 t, and kimberlitic shale graded 4.5 carats per 100 t. The shale has not been mined yet. A layer of pyroclastic kimberlite was found at a depth of 300 m. Most of the other diamondiferous kimberlites found in the vicinity of Shinyanga were subeconomic.

About 3,000 artisanal miners were estimated to be working in the vicinity of the Williamson Mine. The miners worked alluvial deposits of diamonds that resulted from the erosion of the local kimberlites. Resources in these deposits were estimated to grade around 1 carat per 100 tons.

Gemstones.—In 2001, the total production of gemstones fell to 96,866 kg from 150,800 kg in 2000. The production of amethyst, aquamarine, cordierite, garnet, ruby, and sapphire increased, and the production of tanzanite and other gemstones fell. The officially reported production of tanzanite fell to 5,473 kg from 5,516 kg in 2000. The value of tanzanite produced in 2001 amounted to $15.93 million, which was 85% of the total value of gemstone production (S.S. Salim, Tanzanian Ministry of Energy and Minerals, written commun., 2002).

African Gem Resources Ltd. (Afgem) held the rights to mine for tanzanite in block C of the Merelani mining area near Arusha. Indicated resources in block C increased to 4.65 Mt at a grade of 22 carats per metric ton in 2001 from 2.24 Mt at a grade of 22 carats per ton in 2000. In November, Afgem introduced a revised mine plan based on the new resource data. The company's processing plant had the capacity to treat 200 t during each shift; production would run on a single shift basis following the sinking of three mine shafts. Commercial production was expected to start in the third quarter of 2002 (African Gem Resources Ltd., 2002, p. 8, 11-13).

Afgem had lapidaries in South Africa and Tanzania; the latter facility may be expanded under the Export Zone Program. In 2002, Afgem planned to have a lapidary capacity of 147,200 carats per year, which was expected to increase to 230,000 carats per year in 2003 and 331,200 carats per year in 2004. The company expected to cut and polish about 10% of its highest quality rough tanzanite in South Africa and Tanzania. Afgem would also laser-inscribe, package, and certify the high-grade stones. The lower grade stones would be exported to cutting centers in China and India (African Gem Resources Ltd., 2000, p. 19-20; 2002, p. 17, 23).

Kilimanjaro Mines Ltd. held the license to block A. There has been little activity on block A in recent years; its remaining resources were believed to be subeconomic. Blocks B and D of the Merelani deposit were being mined by about 10,000 artisanal miners, who accounted for most of the country's tanzanite production. Ngorongoro Mining Enterprises Ltd. mined as deep as 200 m. Although block C was believed to have the most abundant tanzanite resources, block D had the highest quality.

In April, three associations that represented miners in blocks B and D sued Afgem; they challenged the legality of Afgem's mining license and accused the company of monopolizing the tanzanite market and engaging in misconduct towards small-scale miners. In August, the High Court of Tanzania ruled

Digitized by Google

unanimously in Afgem's favor (African Mining Bulletin, 2001a). At the end of 2001, Afgem still faced the challenge of artisanal miners illegally tunneling into block C from blocks B and D.

The world market for polished tanzanite was more than $400 million per year, of which $300 million per year was consumed by the United States. About 10% of the rough tanzanite was cut domestically; the remainder was exported to Germany, India, and Israel for cutting. Rough exports of tanzanite were estimated to be from about $150 million to $160 million per year, most of which was sold by artisanal miners to middlemen and smuggled out of the country.

In November, the Wall Street Journal reported that supporters of the al-Qaeda terror network were allegedly buying tanzanite in Tanzania and smuggling it to Dubai and Hong Kong for sale (Block and Pearl, 2001). The allegations led QVC Inc., Tiffany & Co., and Zale Corp. to boycott tanzanite. Sales of tanzanite, which were already weakened by the recession in the United States, fell further as a result. The U.S. Department of State reported that no evidence suggested that sales of tanzanite were funding al-Qaeda (Africa Mining Intelligence, 2002; African Gem Mining Ltd., 2002, p. 3, 23; Business Times Market & Economy, 2002).

Rhodolite and tsavorite garnet were found at numerous locations in Tanzania. In 2001, the production of garnet increased to 19,508 kg from 14,940 kg in 2000. The value of garnet produced amounted to $1.01 million in 2001 (S.S. Salim, Tanzanian Ministry of Energy and Minerals, written commun., 2002).

Ngorongoro Mining Enterprises Ltd. mined rhodolite garnet at Landaban, Landanai, and Losoito. Tsavorite, which is a green grossularite garnet that obtains its color from trace amounts of chromium and vanadium, was found near Arusha, Lemshuku, Namungo, and Tunduru. In early 2000, tsavorite prices fell because of increased supply from the Namungo deposit. By February 2001, most of the alluvial resources at Namungo had been depleted. In the second half of 2001, the depletion of alluvial deposits at several tsavorite mines caused production to fall and prices to rise; deeper resources were much less accessible to artisanal miners. Additionally, the discovery of a new aquamarine deposit in Tanzania encouraged miners to leave the tsavorite mines and to pursue aquamarine mining (Henricus, 2001b, c; Jewellery News Asia, 2001).

Emerald has been produced at Manghola and Magara and in the Sumbawanga district. In early December 2000, new deposits of emerald and alexandrite were discovered in Mayoka, which was near the border of Manyara National Park. Large quantities of emerald and smaller amounts of alexandrite were recovered by the 800 miners who worked in the area. In mid-December 2000, the Government temporarily halted mining in the area for environmental reasons (Shigley and others, 2000, p. 311; Henricus, 2001a).

The primary ruby-producing districts have been the Mahenge, Matombo, Morogoro, and Tunduru. Sapphire has been produced particularly in the Songea, the Tunduru, and the Umba Valley districts. The production of sapphire increased to 3,576 kg in 2001 from 2,531 kg in 2000, and ruby, to 1,174 kg from 1,070 kg. In 2001, the value of sapphire and ruby output amounted to $490,000 and $71,000, respectively (S.S. Salim, Tanzanian Ministry of Energy and Minerals, written commun., 2002).

In 2000, GTN Resources Ltd. of Australia formed a joint venture to explore for sapphire in the Songea and Tunduru districts. In November 2001, the company decided to relinquish its title to the area because of high costs and risks. Pacific Mining Corporation Pty. Ltd. held the Liparamba, Matemango, and Muhuwesi gemstone concessions in Tunduru, upon which garnet, ruby, and sapphire have been discovered. In June 2001, Caesars Explorations Inc. of Canada acquired a 100% share in Pacific Mining. Caesars planned to start operations in the fourth quarter of 2001. Seab Gems Ltd. mined for ruby in the Mahenge and Morogoro districts and for sapphire in the Tanga district (Shigley and others, 2000, p. 314-315; Caesars Explorations Inc., 2001a, b; Jewellery News Asia, 2002).

Other gemstone occurrences included opal in the Kasulu district; olivine at Kingiti in the Gelai district; scapolite in the Dodoma district; spinel in the Mhuva, Songea, and Tunduru districts; topaz in the Longido, Magagoni, and Mhuva districts; tourmaline in the Daluni, Mpwapwa, Ngomeni, and Umba Valley districts; and zircon at Muhuwesi in the Tunduru district (Shigley and others, 2000, p. 319-323, 325).

Kaolin and Other Clays.—Notable deposits of kaolin occurred at Pugu, which was to the west of Dar es Salaam. Domestic production of kaolin ceased in 1997, but other clays were produced for use in the construction sector (table 1).

Limestone and Other Stone.—The Tanga and Wazo Hill limestone deposits have been developed for use in the cement industry; another substantial limestone deposits is Lindi. Marble from the Mbarali deposits has been used for the production of lime. During a visit in February 2002, the author observed numerous small-scale crushed stone operations in rural areas that used labor-intensive production processes.

The production of crushed limestone increased to nearly 2.27 Mt from 1.5 Mt in 2000 and 1.2 Mt in 1996. The output of pozzolanic materials increased to 57,014 t in 2000 from 2,274 t in 1999 before falling to 41,468 t in 2001. According to official statistics, about 108,000 t/yr of stone and aggregate were produced in the area of Dar es Salaam; other estimates run as high as three times this figure. The extraction of coral, limestone, and sand has caused damage to the environment through the diversion of streams and rivers. About 130,000 t/yr of waste rock was crushed and mixed with cement to use as backfill in the Bulyanhulu underground mine (Menda, 2002; S.S. Salim, Tanzanian Ministry of Energy and Minerals, written commun., 2002).

Salt.—Substantial deposits of rock salt were found near Mandawa. The domestic demand for salt was about 120,000 t/yr. Tanzania's salt production declined to 65,000 t in 2001 from 70,000 t in 2000 and 86,700 t in 1996 (S.S. Salim, Tanzanian Ministry of Energy and Minerals, written commun., 2002). Domestic salt producers included H.J. Stanley & Sons Ltd., Mtawanya Saltworks Ltd., Mtwara Oceanic Products Ltd., and Nyanza Salt Mines (T) Ltd. In 2001, KfW Bankengruppe

Digitized by Google

of Germany offered a $9 million loan to Nyanza Salt Mines that would allow the company to increase its production to 60,000 t/yr. The company planned to export some of its output; export revenues were expected to be $4.5 million per year.

Silica Sand.—High-quality silica sands were located near Bukoba, which was a port on Lake Victoria. During a visit in February 2002, officials from the Government of Tanzania informed the author that private investors had expressed some interest in mining the Bukoba deposits. Silica sands were also found at Pugu. Kioo Ltd. operated a plant in Dar es Salaam that produced glass bottles and containers.

Mineral Fuels

Coal.—The Kiriwa coalfield produced small amounts of bituminous coal, most of which were consumed at a powerplant near the mine. Bituminous coal deposits in the Ruhuhu coalfield included the Ketewaka, Mbalawala, Mbuyura, and Mchuchuma; other bituminous coalfields included the Gahula and Njuga. The largest subbituminous coalfields were the Mhukuru and Ufipa. In 2001, Tanzania's coal production fell to 77,789 t from 79,184 t in 2000 and 52,000 t in 1996 (British Geological Survey, written commun., 2002; S.S. Salim, Tanzanian Ministry of Energy and Minerals, written commun., 2002).

The NDC held a prospecting license for Mchuchuma and Ketewaka; the company sought assistance from investors to finance a new opencast coal mine at Mchuchuma with a capacity of 1.5 Mt/yr of coal and a coal-fired powerplant with a capacity of 400 megawatts (MW). The feasibility study conducted by the NDC established the viability of the project (Mchihiyo, 2001).

Natural Gas.—Tanzania had substantial resources of natural gas at Songo Songo Island. The Songo Songo Project would deliver natural gas from the Songo Songo field to the Ubungo powerplant in Dar es Salaam, which was operated by Tanzania Electric Supply Company Ltd., and to TPCC's cement plant at Wazo Hill. The project would involve installing a gas processing plant on Songo Songo Island with a capacity of about 410 million cubic meters per year; constructing a 248-km pipeline to Dar es Salaam and Wazo Hill; and converting the 112-MW Ubungo plant from diesel to natural gas (Stell, 2001, p. 85; World Bank, 2002, p. 2).

AES Corp. of the United States was the private sponsor of the Songo Songo project. In October 2001, the World Bank approved a $183 million loan for the project; the European Investment Bank would provide an additional $40 million and CDC Capital Ventures of the United Kingdom, $18 million. Production was expected to start in October 2003 (Africa Energy Intelligence, 2001b).

Petroleum.—Tanzania had a petroleum products refinery with a capacity of 14,900 barrels per day that was operated by Tanzanian & Italian Petroleum Refining Co. Ltd. The refinery shut down because of its outdated technology and high transportation costs; production was unprofitable even after subsidies. In 2001, the Government authorized Antrim Energy Ltd. and Canop Worldwide Corp. to start exploration work. Antrim held the Pemba-Zanzibar block, which covered 14,060 km^2 in the Indian Ocean. The company finalized negotiations with the Government to drill three wells in 2002 at an expected cost of $1.2 million. As of October 2001, Antrim was still negotiating the production-sharing agreement. Canop held an 80% share of the exploration licenses for Dar es Salaam Platform, Kiasangire, and Mafia Island. In the first half of 2002, Canop and its partner Paladin Resources Ltd. planned to drill a well on the Bigwa field, which is part of the Dar es Salaam Platform. Dublin International Petroleum (Tanzania) Ltd. continued to explore on the Mandawa block (Africa Energy Intelligence, 2001a).

Infrastructure

Tanzania had installed capacity of 901 MW in 2001, of which hydroelectric power accounted for 561 MW. Hydroelectric power stations included Kidatu, with a capacity of 204 MW; Kihansi, 180 MW; Mtera, 80 MW; Pangani Falls, 68 MW; and Hale, 21 MW. Thermal power stations included Ubungo with a capacity of 112 MW and Tegeta, 100 MW. The state-owned utility TANESCO produced most of the country's electricity. In 2000, Tanzania generated 2,488 gigawatt hours (GWh) of electricity, which was an increase from 2,325 GWh in 1999 and 1,991 GWh in 1996. Hydroelectric power sources provided 86% and fossil fuels, 14% (Africa Energy & Mining, 1999, 2000; World Bank, 2002, p. 4; Tanzania Investment Centre, undated§).

In spite of the recent additions to Tanzania's power generating capacity, 93% of energy needs were met by traditional fuels, such as firewood. Out of the country's rural population, which was about 85% of the total population, less than 1% had access to electricity. Estimates of deforestation ranged from 1,460 to 4,000 square kilometers per year; fuel accounted for about 97% of Tanzania's wood consumption. TANSECO was establishing a rural electrification fund and developing its Rural Electrification Master Plan. In July 2001, the African Development Fund awarded Tanzania a grant of $2.3 million to finance the study on rural electrification (United Nations Environment Programme, undated; TOMRIC News Agency, 2000§; North South Associates Co. Ltd., 2001§).

In 2001, TANESCO was negotiating with the Zambia Electricity Supply Corporation to link the power grids of Tanzania and Zambia by 2004. This would connect Tanzania's grid to the South African Power Pool and increase stability of supply (Africa Energy Intelligence, 2001c). The Government was also exploring the feasibility of connecting to the Kenyan grid; the cost was estimated to be $50 million.

TANESCO also planned to build new gas-fired powerplants and substitute natural gas for diesel in other plants. In addition to the Songo Songo Project, TANESCO's Power Sector Master Plan also included the conversion of the 100-MW Tegeta powerplant to natural gas and the addition of 150 MW of new gas-fired capacity from 2003 to 2005 (World Bank, 2002, p. 4- 5).

Geothermal areas in Tanzania include Kisaki Tagalala, Mbeya, and Ngorongoro. Most exploration for geothermal energy sources has been very preliminary because of abundant hydropower and

Digitized by Google

plans to develop domestic coal and natural gas resources. The Government sought donor support for village level solar electrification (United Nations Environment Programme, undated).

About 30% of electricity was consumed by the Government; nonpayment of utility bills by Government agencies caused TANESCO substantial financial difficulties. The cement and steel industries consumed between 60 and 120 MW of capacity per year, and the Bulyanhulu Mine, 12 MW. National demand for electricity was growing by 11% to 13% per year; peak demand was expected to reach 850 MW of capacity by 2005 (United Nations Environment Programme, undated; Mande and Mwamunyange, 2001§).

Tanzania had about 85,000 km of roads, of which approximately 4,000 km was paved. Only 14% of the unpaved roads was in good condition; the Government planned to rehabilitate 4,500 km of roads by 2004. The rail network covered about 3,600 km. The country had 982 km of crude petroleum pipelines. Lake Nyasa, Lake Tanganyika, and Lake Victoria were the principal waterways. Ports and harbors were Bukoba, Dar es Salaam, Kigoma, Kilwa Masoko, Lindi, Mtwara, Mwanza, Pangani, Tanga, Wete, and Zanzibar.

Outlook

Tanzania's minerals industry, particularly gold mining, is likely to grow substantially in the near future. With the start of production at the North Mara Mine and the increased output at Bulyanhulu, Tanzania's gold production was expected to rise to about 37 t in 2002. If the capacity expansions at Bulyanhulu, Geita, and Golden Pride are carried out and Nyakafuru is developed, then gold production could rise to 44 t in 2003 and 52 t in 2005. Mineral exports were expected to rise to more than $400 million in 2002 from $312 million in 2001; gold exports were predicted to increase to $326 million from $262.6 million in 2001 (African Mining Intelligence, 2001b).

Investments by Afgem and DeBeers are likely to lead to higher output of diamond and tanzanite; the outlook for these commodities also depends heavily upon world markets. The smuggling of tanzanite is likely to remain a serious issue in the short term because of export taxes, the value of tanzanite, and the ease of concealment. In the long term, the problem is likely to diminish because of resource depletion in blocks B and D.

The International Monetary Fund (2002, p. 174) predicted that Tanzania's GDP would grow by 5.8% in 2002 and 6% in 2003. If similar rates of growth occur in the construction industry, then the production of such construction materials as brick clay, cement, gypsum, limestone, and sand and gravel could increase substantially.

References Cited

Africa Energy & Mining, 1999, Tanzania—On track for privatization: Africa Energy & Mining, no. 253, June 2, p. 6.

Africa Energy & Mining, 2000, Tanzania—Kihansi a welcome contribution: Africa Energy & Mining, no. 280, July 26, p. 5.

Africa Energy Intelligence, 2001a, Tanzania—New exploration push: Africa Energy Intelligence, no. 307, October 3, p. 4.

Africa Energy Intelligence, 2001b, Tanzania—Songo Songo awarded $250 million: Africa Energy Intelligence, no. 308, October 17, p. 7.

Africa Energy Intelligence, 2001c, Zambia/Tanzania—Plans for interconnection: Africa Energy Intelligence, no. 294, March 7, p. 6.

Africa Mining Intelligence, 2001a, Tanzania—Tanzanite sales hit $32 million: Africa Mining Intelligence, no. 10, March 14, p. 3.

Africa Mining Intelligence, 2001b, Tanzania—Year 2001 great for gold: Africa Mining Intelligence, no. 28, December 19, p. 1.

Africa Mining Intelligence, 2002, Tanzania—Small-scale miners issue warning to Afgem: Africa Mining Intelligence, no. 34, March 20, p. 2.

African Gem Resources Ltd., 2000, Unearthing Africa's wealth: Johannesburg, South Africa, African Gem Resources, Ltd., 39 p.

African Gem Resources Ltd., 2002, Annual report 2002: Johannesburg, South Africa, African Gem Resources Ltd., 56 p.

African Mining, 2001a, Bulyanhulu—Barrick's brilliant new star: African Mining, v. 6, no. 2, March-April, p. 46-49.

African Mining, 2001b, Exploration—Tanzania: African Mining, v. 6, no. 6, November-December, p. 15-16.

African Mining, 2001c, Goldstream finds platinum in Tanzania: African Mining, v. 6, no. 5, September-October, p. 21.

African Mining Bulletin, 2001a, Tanzania—Court rules in favor of Afgem: African Mining Bulletin, no. 153, October 12, p. 2-3.

African Mining Bulletin, 2001b, Tanzania—IGE to assist with small-scale gold mining: African Mining Bulletin, no. 143, May 25, p. 3.

African Mining Bulletin, 2001c, Tanzania—Robust grades at Tulawaka: African Mining Bulletin, no. 152, August 21, p. 3.

Ashanti Goldfields Co. Ltd., 2002, Annual report 2001: Accra, Ghana, Ashanti Goldfields Co. Ltd., 65 p.

Barrick Gold Corp., 2002a, Barrick analyst briefing 2002: Toronto, Ontario, Canada, Barrick Gold Corp., 83 p.

Barrick Gold Corp., 2002b, Annual report 2001: Toronto, Ontario, Canada, Barrick Gold Corp., 98 p.

Block, Robert, and Pearl, Daniel, 2001, Underground trade—Much-smuggled gem called tanzanite helps bin Laden supporters: Wall Street Journal, November 16, p. A1, A8.

Business Times Market & Economy, 2002, Reprieve for tanzanite industry: Business Times Market & Economy, February 15, p. 2.

Caesars Exploration Inc., 2001a, Caesars Exploration Inc. announces acquistion: Surrey, British Columbia, Canada, Caesars Exploration Inc. press release, September 25, 2 p.

Caesars Exploration Inc., 2001b, Title acqusition of Tanzanian gemstone properties 225 sq. kilometers: Surrey, British Columbia, Canada, Caesars Exploration Inc. press release, June 8, 2 p.

DeBeers Group, 2002, Annual review 2001: Johannesburg, South Africa, DeBeers Group, 66 p.

Goldstream Mining NL, 2001, Annual report 2001: West Perth, Australia, Goldstream Mining NL, 40 p.

Henricus, Jennifer, 2001a, New gem rush in Tanzania: Jewellery News Asia, no. 197, January, p. 78-80.

Henricus, Jennifer, 2001b, New large Tanzanian deposits help broaden appeal of tsavorite: Jewellery News Asia, no. 198, February, p. 58-64.

Henricus, Jennifer, 2001c, Tsavorite is likely to become a mainstream stone if production keeps rising: Jewellery News Asia, no. 198, February, p. 64.

Holcim Ltd., 2002, Annual report 2001: Zurich, Switzerland, Holcim Ltd., 47 p.

International Cement Review, 2001, Tanzania, *in* The global cement report: Dorking, United Kingdom, Tradeship Publications, Ltd., p. 296.

International Iron and Steel Institute, 2001, Steel statistical yearbook 2001: Brussels, International Iron and Steel Institute, 109 p.

International Monetary Fund, 2002, World economic outlook—Trade and finance: Washington, D.C., International Monetary Fund, September, 235 p.

International Monetary Fund, 2003, Tanzania—Selected issues and statistical appendix: Washington, D.C., International Monetary Fund, January 7, 136 p.

Jewellery News Asia, 2001, Supplier notes tsavorite price increase: Jewellery News Asia, no. 207, November, p. 32.

Jewellery News Asia, 2002, GTN cuts production, pulls out of Tanzania: Jewellery News Asia, no. 210, February, p. 94.

Jones, Andrew, 1999, Africa lags in race for low-cost nickel: African Mining, v. 4, no. 6, November-December, p. 66-69.

Lion Selection Group Ltd., 2002, Annual report 2001: Melbourne, Australia, Lion Selection Group Ltd., 65 p.

Mchihiyo, E.P., 2001, Tanzania, *in* Mining annual review 2001: London, United Kingdom, Mining Journal Ltd. CD-ROM.

Mchihiyo, E.P., 2002, Tanzania, *in* Mining annual review 2002: London, United Kingdom, Mining Journal Ltd. CD-ROM.

Menda, Aloyce, 2002, Quarries threaten Dar's environment: Business Times Market & Economy, February 8, p. 10.

Digitized by Google

Resolute Mining Ltd., 2001a, Annual report 2001: Perth, Australia, Resolute Mining Ltd., 52 p.
Resolute Mining Ltd., 2001b, Report on activities for the quarter to 30 June 2001: Perth, Australia, Resolute Mining Ltd., 8 p.
Resolute Mining Ltd., 2002, Report on activities for the quarter to 31 December 2001: Perth, Australia, Resolute Mining Ltd., 6 p.
Resource Information Unit, 2001, Tanzania, *in* Register of African mining 2001/02: Subiaco, Australia, Resource Information Unit, p. 279-301.
Shigley, J.E., Dirlam, D.M., Laurs, B.M., Boehm, E.W., Bosshart, George, and Larson, W.F., 2000, Gem localities of the 1990s: Gems & Gemology, v. 36, no. 4, winter, p. 292-335.
Stell, Jeannie, 2001, Worldwide construction: Oil & Gas Journal, v. 99, no. 16, April 16, p. 67-96.
Sub-Sahara Resources NL, 2001, Annual report 2001: Perth, Australia, Sub-Sahara Resources NL, 44 p.
Twigg Minerals plc, 2002, Annual report 2001: Lymington, United Kingdom, Twigg Minerals plc, 22 p.
United Nations Environment Programme, [undated], Tanzania country assessment 2001: Paris, France, United Nations Environment Programme, 7 p.
United Nations Industrial Development Organization, 2000a, Industrial investment and technology project profile—Nails, wire mesh, and corrugated iron (Jeje): Vienna, Austria, United Nations Industrial Development Organization, 10 p.
United Nations Industrial Development Organization, 2000b, Industrial investment and technology project profile—Steel rolling (SITA): Vienna, Austria, United Nations Industrial Development Organization, 11 p.
World Bank, 2002, United Republic of Tanzania—Songo Songo gas development and power generation project—Environment and social assessment and management plan summary: Washington, DC, World Bank, 27 p.

Internet References Cited

International Monetary Fund, 2002a (April), Gross domestic product at current prices—All countries, World Economic Outlook Database, accessed August 14, 2002, via http://www.imf.org/external/pubs/ft/weo/2002/01/data/ngdpd_a.csv.
International Monetary Fund, 2002b (April), Selected world aggregates, World Economic Outlook Database, accessed June 10, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/01/data.
International Monetary Fund, 2002c (April), Shares of aggregate GDP based on purchasing power parity (PPP) valuation of country GDP—Developing countries, World Economic Outlook Database, accessed June 10, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/01/data.
Mande, Mike, and Mwamunyange, Joseph, 2001 (July 30), Tanzanian industry divided over IPTL ruling, accessed September 24, 2002, at URL http://www.nationaudio.com/News/EastAfrican/06082001/Regional/Regional20.html.
North South Associates Co. Ltd., 2001 (July 27), Fund injects $2.34m into rural electrification program, accessed September 25, 2002, at URL http://www.yourworldoffinancialservices.com/News/July/news55.asp.
Tanzania Investment Centre, [undated], Electricity supply, accessed September 25, 2001, via URL http://www.tic.co.tz/IPA_Information.asp?hdnGroupID=3&hdnLevelID=5.2.
TOMRIC News Agency, 2000 (January 7), Deforestation in Tanzania alarming, accessed September 25, 2002, at URL http://allafrica.com/stories/printable/200001070106.html.

TABLE 1
TANZANIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1997	1998	1999	2000	2001
Calcite e/		40	40	40	40	40
Cement, hydraulic	thousand tons	621	778	833	833	900
Clays:						
Bentonite		-- r/	-- r/	-- r/	-- r/	--
Kaolin		898 r/	-- r/	-- r/	-- r/	--
Coal, bituminous		28,443 r/	45,073 r/	75,044 r/	79,184 r/	77,789
Copper, contained in concentrates and doré		--	--	--	--	2,645
Diamond 3/	carats	123,090 r/	97,830 r/	234,800	354,388 r/	254,271
Gemstones, excluding diamond 4/						
Amethyst e/	kilograms	155	180	230	239 5/	277 5/
Aquamarine e/	do.	125	140	200	205 5/	454 5/
Cordierite (iolite) e/	do.	100	120	155	158 5/	312 5/
Garnet e/	do.	14,000	14,100	14,100	14,940 5/	19,508 5/
Ruby e/	do.	900	1,000	1,000	1,070 5/	1,174 5/
Sapphire e/	do.	2,400	2,450	2,500	2,531 5/	3,576 5/
Tanzanite	do.	810	1,226	5,216	5,516	5,473
Other e/	do.	491,000	29,300	71,800	126,141 5/	66,092 5/
Total	do.	509,000	48,500	95,200	150,800	96,866
Gold, refined	do.	232	427	4,890 r/	15,060	30,088
Graphite		11,000	--	--	--	--
Gypsum and anhydrite, crude		46,320 r/	59,066 r/	21,195 r/	60,000	72,000
Iron ore:						
Gross weight		91,200	--	--	--	--
Fe content		29,200	--	--	--	--
Limestone, crushed		--	1,181,233 r/	1,241,155 r/	1,500,000	2,269,359
Petroleum fuels		313,000	312,000	287,000	117,000	--
Phosphate minerals:						
Apatite		7,070 r/	4,790 r/	24,200 r/	17,000 r/	13,300
P_2O_5 content		2,120 r/	1,437 r/	7,250 r/	5,100 r/	4,000

See footnotes at end of table.

Digitized by Google

TABLE 1--Continued
TANZANIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1997	1998	1999	2000	2001
Pozzolanic materials		--	--	2,274	57,014	41,468
Salt, all types		72,511 r/	75,000	35,893 r/	70,000	65,000
Sand, glass e/		4,200	4,200	-- r/	-- r/	--
Silver, contained in concentrates and doré	kilograms	--	--	276	1,384	6,861
Soda ash e/		-- r/	-- r/	-- r/	-- r/	--
Steel, semimanufactured		12,498	9,522	9,500 r/	11,182	16,100

e/ Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. r/ Revised. -- Zero.
1/ Includes data available through October 3, 2002.
2/ In addition to the commodities listed, modest quantities of unlisted varieties of crude construction materials (other clays, sand and gravel, and stone) presumably are produced, but output is not reported quantitatively, and available information is inadequate to make reliable estimates of output levels.
3/ Diamond figures are estimated to represent 85% gem-quality or semi-gem-quality and 15% industrial-quality stones. Does not include smuggled artisanal production
4/ Other precious and semiprecious stones produced included chrysoprase, emerald, peridot, and tourmaline.
5/ Reported figure.

TABLE 2
TANZANIA: STRUCTURE OF THE MINERALS INDUSTRY IN 2001

(Metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Cement		Tanzania Portland Cement Co. Ltd. (Heidelberg Cement, 41%)	Wazo Hill	500,000 mill; 800,000 kiln.
Do.		Tanga Cement Co. Ltd. (Holcim Ltd., 60%; Saruji Corp., 40%)	Tanga	500,000 mill; 500,000 kiln.
Do.		Mbeya Cement Co. Ltd. (LaFarge Group, 58%)	Mbeya	250,000 mill; 250,000 kiln.
Coal, bituminous		Tanzania-China Kiwira Coal and Power (Hunan International Economic and Technical Cooperation Co., 62%; Government, 38%)	Kiwira Mine	150,000 run of mine; 93,000 washed.
Copper, in concentrates		Kahama Mining Corp. Ltd. (Barrick Gold Corp., 100%)	Bulyanhulu Mine near Kahama	20,000 concentrate; 3,600 contained copper.
Diamond		Williamson Diamonds Ltd. (DeBeers Group, 75%; Government, 25%)	Mwadui Mine near Shinyanga	2,400,000 ore processing.
Do.	carats	do.	do.	160,000 diamond.
Gold		Anglogold Ltd., 50%; and Ashanti Goldfields Co. Ltd., 50%	Geita Mine near Nyakabale	4,000,000 ore processing.
Do.	kilograms	do.	do.	15,600 gold.
Do.		Kahama Mining Corp. Ltd.	Bulyanhulu Mine near Kahama	1,095,000 ore processing.
Do.	kilograms	do.	do.	12,400 gold.
Do.		Resolute Mining Ltd.	Golden Pride Mine near Isanga	1,650,000 ore processing.
Do.	kilograms	do.	do.	5,600 gold.
Petroleum products	thousand barrels	Tanzanian & Italian Petoleum Refining Co. Ltd.	Dar es Salaam	5,440.
Phosphate rock		Minjingu Phosphate Co. Ltd.	Minjingu	30,000.
Rhodolite		Ngorongoro Mining Enterprises Ltd.	Landanai	NA.
Do.		do.	Landaban	NA.
Do.		do.	Losoito	NA.
Steel		SITA Rollings Ltd.	Dar es Salaam	14,000 cold rolled.
Tanzanite		African Gem Resources Ltd.	Merelani, block C	52,000 ore processing.
Do.	carats	do.	do.	1,144,000 tanzanite.
Do.		Ngorongoro Mining Enterprises Ltd.	Merelani, block B	NA.

NA Not available.

Digitized by Google

TABLE 3
TANZANIA: GOLD RESOURCES AND RESERVES IN 2001 1/

Project	Major operating companies	Tonnage (million metric tons)	Grade (grams per metric ton)	Contained gold (metric tons)
Reserves:				
Bulyanhulu	Kahama Mining Corp. Ltd. (Barrick Gold Corp., 100%)	28.0	13.3	374
Geita	Geita Gold Mines (Anglogold Ltd., 50%; Ashanti Goldfields, 50%)	62.7	3.8	240
North Mara	East African Gold Mines Ltd.	19.1	3.3	65
Golden Pride	Resolute Mining Ltd.	13.8	2.5	35
Total		123.6	5.7	710
Resources:				
Bulyanhulu	Kahama Mining Corp. Ltd.	37.3	13.6	508
Geita	Geita Gold Mines	88.4	3.9	345
North Mara	East African Gold Mines Ltd.	49.6	2.6	128
Golden Pride	Resolute Mining Ltd.	28.7	2.4	69
Golden Ridge 2/	Kahama Mining Corp. Ltd.	NA	NA	68
Chocolate Reef	do.	25.7	2.3	59
Tulawaka:				
East Zone	Barrick Gold Corp., 70%; Exploration Minieres du Nord, 30%	1.0	19.0	23
West Zone	do.	0.7	2.9	2
Buhemba	Meremeta Ltd	11.4	2.0	23
Nyakafuru	Spinifex Gold Ltd.	3.6	6.3	23
Buckreef/Rwamagaza	do.	5.0	4.1	19
Kitongo	do.	10.5	6.3	15
Kisunge Hill	Tan Range Exploration Corp.	9.4	1.0	9
Ikungu	Conquest Resources Ltd.	2.6	2.3	6
Miyabi	Twigg Minerals plc	2.2	2.1	5
Total		276.0 3/	4.5 3/	1,300

NA Not available.
1/ Totals may not add because of independent rounding.
2/ Estimate of resources in December 1997 was 33.1 million metric tons at a grade of 1.48 grams per ton, or 49 metric tons of contained gold.
3/ Does not include Golden Ridge.

Sources: African Mining Bulletin, 2001c; Ashanti Goldfields Co. Ltd., 2002; Barrick Gold Corp., 2002b; Lion Selection Group Ltd., 2002; Resolute Mining Ltd., 2001a, 2002; Resource Information Unit, 2001; Twigg Minerals plc, 2002.

Digitized by Google

THE MINERAL INDUSTRY OF

TUNISIA

By Philip M. Mobbs

Production and processing of crude oil, mining of phosphate rock, and the manufacturing of phosphate-based fertilizer products were significant segments of the Tunisian minerals industry.

The minerals sector accounted for about 4% of the gross domestic product (GDP) of the country's diversified economy. In 2001, the Tunisian minerals industry was adversely affected by the downturn in the international prices of crude oil, petroleum products, phosphate rock, and zinc and the resumption of the decline (which had originally begun in 1993) in the local production of crude oil.

The nominal GDP of this North African nation was estimated to have been more than $20 billion[1] in 2001 compared with $19.6 billion in 2000. Hydrocarbon production and processing accounted for about 2.9% of the GDP compared with 3% in 2000, and mining declined to about 0.8% compared with 0.9% in 2000 (Central Bank of Tunisia, 2002, p. 43, 58).

In 2001, the value of total Tunisian exports jumped to about $6.6 billion compared with $5.9 billion in 2000. Most of the increase was associated with textiles ($621 million). The value of exports of cement, phosphate-based fertilizers, phosphate rock, zinc, and other minerals was estimated to be about $595 million. For 2001, the total value of imports was estimated to be $9.6 billion. Imports of minerals and mineral-based products were valued at about $379 million. For the second year in a row, Tunisia was a net importer of crude oil and petroleum products. Crude oil and petroleum products exports were valued at about $613 million in 2001, and imports of mineral fuels, at about $890 million (Central Bank of Tunisia, 2002, p. 111, 114, 118, 121).

Commodity Review

Metals

Iron and Steel.—Iron ore production rebounded in 2001. Société du Djebel Djerissa produced about 70% of its iron ore output from the underground Djerissa Mine and about 30% from the open pit Tamera-Douaria operation.

A five-stand continuous finishing mill was commissioned at the Intermetal S.A. steel bar and section mill in Tunis. Danieli Morgårdshammar S.A. continued with its upgrade of the Intermetal works and began the acquisition and installation of a new continuous roughing/intermediate mill. The renovation of Intermetal's 300,000-metric-ton-per-year (t/yr)-capacity facility was scheduled to be completed in early 2002 (Danieli Morgårdshammar S.A., 2001).

Lead and Zinc.—Breakwater Tunisia S.A. operated the underground Bougrine lead-zinc mine and a 1,200-metric-ton-per-day (t/d)-capacity mill (Breakwater Resources Ltd., 2002b, p. 41). Additional lead-zinc ore was mined at the Boujabeur Mine (at the rate of about 150 t/d) operated by Société Minière du Nord-Ouest and the Fej Lahdoum Mine at Nar d'Hal (at about 100 t/d) (Consolidated Global Minerals Ltd., 2001a, p. 16). In October, Consolidated Global Minerals Ltd. of Canada announced that it had acquired an option from the Government to operate the Boujabeur and Fej Lahdoum Mines for 3 years (Consolidated Global Minerals Ltd., 2001b).

During 2001, Breakwater milled 411,052 metric tons (t) of ore to produce 69,724 t of zinc concentrates that contained 37,832 t of zinc and 9,869 t of lead concentrates that contained 6,424 t of lead (Breakwater Resources Ltd., 2002a, p. 11). Breakwater continued exploration in the vicinity of the mine. Its Kebbouch-Sud exploration permit was renewed until February 2004. As of November, Bougrine had proven and probable reserves of 1.68 million metric tons (Mt) of ore at a grade of 10.94% zinc and 2.1% lead (Breakwater Resources Ltd., 2002b, p. 38-44). Continuing to mine at the rate of at least 400,000 t/yr of ore would exhaust the mine's proven and probable reserves by 2005.

In 2001, Aurora Metals Ltd. of the British Virgin Islands mapped, ran geochemical evaluations of, and began a drilling program on the Hammala, Koudiat ed Diss, and Koudiat Sidi Amor permits. Consolidated Global Minerals began geologic studies of the Djebba prospect, the four exploration permits of the Fej Lahdoum-Ain Jemmala zinc-lead project, the Koudiat El Louatia property, and the Ouled Moussa permit. International Bravo Resource Corp. of Canada withdrew from a joint venture on the Djebba property with Consolidated Global Minerals, citing low zinc prices.

Industrial Minerals

Cement.—Société des Ciments d'Enfida (a subsidiary of Corporación Uniland, S.A., of Spain) proposed a two-phase 26-month program that would double its capacity to 2 million metric tons per year. Polysius S.A. (a subsidiary of ThyssenKrupp AG) was awarded the $57 million contract for the expansion program (Middle East Economic Digest, 2001).

Phosphate Rock.—In 2001, open pit mining accounted for about 91% of the 11.5 Mt of crude phosphate rock that

[1]Where necessary, values have been converted from Tunisian dinars (TD) to U.S. dollars (US$) at an average rate of TD1.43=US$1.00 for 2001 and of TD1.36=US$1.00 for 2000.

Digitized by Google

Compagnie des Phosphates de Gafsa (CPG) mined primarily from the Kef Eschfair Mine (which accounted for 31% of total ore volume), the Kef Eddour Mine (29%), and the Jallabia Mine (18%). The slight increases in export and local demand were met by the company's production of about 8.1 Mt of washed phosphate rock. CPG's stockpile of marketable phosphates remained at about 2.7 Mt (Central Bank of Tunisia, 2002, p. 59-60).

Mineral Fuels

The Hydrocarbon Code (law No. 99-93 of August 17, 1999) regulated oil and gas exploration and production in Tunisia. In 2001, production of natural gas, which was primarily from the offshore Miskar Field, was reported to have increased to 2,254 million cubic meters (Central Bank of Tunisia, 2002, p. 63). British Gas Tunisia Ltd., which operated the Miskar Field, acquired a three-dimensional seismic survey on the Amilcar permit and proposed to drill three more development wells in the Miskar Field and an additional exploration well on the offshore Hasdrubal prospect. British Gas planned to begin production from Hasdrubal in 2006.

Crude oil production from the major Tunisian oilfields continued to decline. Production from the El Borma Field dropped by 8.1% compared with that of 2000, and that from the offshore Ashtart Field, by 7.9%. In 2001, four exploration wells were drilled including the Douz No. 1 on the Bazma permit of Pioneer Natural Resources Corp. and Eurogas Corp. No new discoveries were made.

In 2001, Pioneer acquired 30% interest in the Anaguid permit from the bankrupt Coho Anaguid, Inc. Coho Energy, Inc.'s other Tunisian subsidiary (Coho International Ltd.) divested its interest in the Fejaj permit to the other partners on the permit. Fejaj Joint Venture Group proposed to deepen the Chott Fejaj No. 2 exploration well in 2002. Eurogas and Pioneer acquired seismic surveys on the El Hamra and Jorf permits and proposed to drill an exploration well on the Jorf permit in 2002. Anschutz Overseas Corp. acquired a reconnaissance permit on the Chobane block.

Centurion Energy International Inc.'s local subsidiary's unsuccessful horizontal sidetrack of the Al Manzah No. 3 well was converted to a water-injection well to maintain reservoir pressure in the Bou Dabbous Formation. Centurion's Al Manzah No. 2 oilwell in the Bou Dabbous had been shut down earlier in 2001 because the increasing gas-to-oil ratio indicated that it was beginning to produce the structure's gas cap. Société d'Electricité d'El Bibane (a joint venture of Centurion and Caterpillar Power Ventures International Inc.) was building a 27-megawatt powerplant at Zarzis. Natural gas from the El Biban and Ezzaouia Fields that previously had been flared will fuel the powerplant (Oil & Gas Journal, 2002).

References Cited

Breakwater Resources Ltd., 2002a, Breakwater announces year-end financial and operating results: Toronto, Ontario, Canada, Breakwater Resources Ltd. press release, March 1, 17 p.

Breakwater Resources Ltd., 2002b, Form 20-F—Fiscal year ended December 31, 2001: U.S. Securities and Exchange Commission, 148 p.

Central Bank of Tunisia, 2002, Annual report—2001: Tunis, Tunisia, Central Bank of Tunisia, 234 p.

Consolidated Global Minerals Ltd., 2001a, Annual information form—2001: Vancouver, British Columbia, Canada, Consolidated Global Minerals Ltd., December 20, 20 p.

Consolidated Global Minerals Ltd., 2001b, Option agreement acquired on two operating mines—Tunisia—North Africa: Vancouver, British Columbia, Canada, Consolidated Global Minerals Ltd. press release, October 4, 1 p.

Danieli Morgårdshammar S.A., 2001, Intermetal—Tunisia—Commissions upgraded bar/section mill: Cranberry Township, Pennsylvania, Danieli Morgårdshammar S.A. press release, 1 p.

Middle East Economic Digest, 2001, Polysius to upgrade Enfida cement plant Middle East Economic Digest, v. 45, no. 28, July 13, p. 14.

Oil & Gas Journal, 2002, Tunisian fields to feed independent gas-power project: Oil & Gas Journal, v. 100, no. 13, April 1, p. 40.

Major Sources of Information

Ministere de l'Industrie
37 Avenue Kheireddine Pacha
1002 Tunis, Tunisia
Telephone: +(216-1) 289-368
Fax: +(216-1) 782-742
E-mail: mind@ministeres.tn

National Office of Mines
Department de Geologie
95 Avenue Mohamed V
1002 Tunis Le Belvedere
Tunisia

Digitized by Google

TABLE 1
TUNISIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Thousand metric tons unless otherwise specified)

Commodity 2/		1997	1998	1999	2000	2001 p/
METALS						
Iron and steel:						
Iron ore:						
Direct shipping ore and concentrate, gross weight		252	220	219	182	204
Fe content		137	119	119	98	109 e/
Metal:						
Pig iron		152	123	180	196	192
Steel, crude		195	171	229	237	239
Lead, mine output, Pb content	metric tons	1,424	4,272	6,589	6,602	6,820 e/
Silver metal, primary e/	kilograms	300	2,500	4,000	3,700	3,650
Zinc:						
Concentrate, gross weight	metric tons	5,389	57,036	89,213	74,996	73,000
Zn content	do.	2,967	31,368	49,066	41,247	40,000 e/
INDUSTRIAL MINERALS						
Barite	do.	12,841	8,011	530	3,702	4,000
Cement, hydraulic 3/		4,424	4,588	4,864	5,657 r/	5,721
Clays, for construction and clay products		3,280	3,478	3,670	3,870	4,260
Fertilizers:						
Triple-superphosphate		748	767	812	805	783
Phosphoric acid		984	1,184	1,208	1,043	1,144
Diammonium-phosphate		745	919	1,048	1,113	1,124
Ammonium nitrate		165	156	172	182	170
Fluorspar, acid grade	metric tons	1,426	1,190	520	--	--
Gypsum e/ 4/		100	100	110 r/	125 r/	125
Lime		466	482	475	517 r/	467
Phosphate rock, washed:						
Gross weight		6,941	7,901	8,006	8,339	8,144
P_2O_5 content e/		2,140	2,370	2,400	2,500	2,440
Salt, marine		393	473	447	620 r/	654
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	1,866	1,899	1,819	1,985 r/	2,254
Dry e/	do.	1,500	1,500	1,450	1,600 r/	1,800
Petroleum:						
Crude	thousand 42-gallon barrels	26,841	30,570	30,960	28,207	26,300
Refinery products:						
Liquefied petroleum gas	do.	1,353	1,473	1,288	1,279	1,180
Gasoline	do.	3,179	2,951	3,096	3,301	3,460
Kerosene	do.	827	978	1,194	1,216	1,560
Distillate fuel oil	do.	4,842	4,178	3,812	4,010	3,480
Residual fuel oil	do.	3,956	4,202	4,149	4,346	3,910
Other e/	do.	2,000	800	1,420	940	980
Total e/	do.	16,200	14,600	15,000	15,100	14,600

e/ Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. p/ Preliminary. r/ Revised. -- Zero.
1/ Data available as of September 12, 2002.
2/ In addition to the commodities listed, a variety of crude construction materials (sand and gravel and stone) was produced, but output was not reported, and available information was inadequate to make estimates of output.
3/ Includes white cement production, in thousand metric tons: 1997--155; 1998--167; 1999--192; 2000--250; and 2001--247.
4/ Does not include phosphatic gypsum (waste product) generated during fertilizer production.

Digitized by Google

Digitized by Google

THE MINERAL INDUSTRY OF

ZAMBIA

By George J. Coakley

Zambia is a landlocked country in southern Africa with an area of 752,614 square kilometers (km^2), 9.8 million people, and a per capita gross domestic product (GDP) purchasing power parity estimated to be $880[1] for 2000 (the latest year for which purchasing power parity data were available). In 2001, overall, mining and quarrying accounted for about 6% of real GDP, 68% of merchandise exports, and about 40,000 jobs of a total formal sector of 470,000. Total merchandise exports in 2001 were $871 million, of which metals accounted for $590 million. Fuel and energy imports accounted for about 10% of total merchandise imports of $1,253 million (International Monetary Fund, 2002§[2]).

The Zambian economy was beginning to get back on its feet in 2001 following completion of most of its privatization program in 2000 and reinjection of investment capital, especially in the mining sector. It experienced a 5.2% growth in real GDP compared with 3% in 2000; between 1990 and 1999, Zambia's average GDP growth rate of 1% per year was the lowest in the Southern Africa Development Community. During 2001, inflation declined to 18.7% from 30%. The International Monetary Fund (IMF) wrote off $3.6 billion of Zambia's $6.5 billion external debt under its Enhanced Highly Indebted Poor Country Initiative, which reduced its external debt service to $165 million per year from $600 million per year. In cooperation with the IMF and the World Bank, the Government also prepared a comprehensive poverty reduction strategy paper (PRSP), which included targeted goals for the mining sector with an emphasis on the development of new large mines and on more technical and economic support for the small-scale mining and related value-added industries. These will include promotion of new jobs in the agricultural and industrial minerals areas, such as limestone for agriculture and clays for brick making and pottery. In the emerald and gemstone sector, a gemstone exchange scheme will be reintroduced to bring together small-scale miners with producers and buyers of rough and processed gemstones and jewelry, to add accountability and transparency, and to reduce the loss of tax revenue from illegal trafficking in gemstones. The PRSP also calls for the creation of a Mining Community Development Fund, which will be funded by the large producing mines, to support community development projects in areas where the mines operate (International Monetary Fund, 2002§).

The mining sector was dominated by copper and cobalt production. Zambia ranked as the world's 4th largest producer of cobalt, the 12th largest copper producer, and one of the top producers of gem-quality emeralds in 2001. Besides copper and cobalt, Zambia produced gold, selenium, and silver as byproducts of copper refining, a variety of industrial mineral commodities, and coal (table 1). Gemstones, mostly emeralds, also recorded significant earnings, but probably an even larger amount bypassed official channels.

The country suffered a major setback in January 2002 when Anglo American plc [the owner of Konkola Copper Mines plc (KCM)] announced that it would write off $350 million in Zambian assets (Anglo American plc, 2002§). High operating costs and low copper and cobalt prices also affected several other producers and led to some suspension of operations or partial asset writeoffs in late 2001 and early 2002. The Government, with the assistance of the World Bank and others, was investigating options for preserving revenue flows and employment from this key sector of the economy.

Government Legislation and Policies

The Investment Act of 1993 established the Zambia Investment Center as a one-stop support facility for investors that offers incentives to investors in the mining sector. The Act, as amended in 1996, regulates, for example, investment incentives and investment guarantees. Investment is protected by the Securities Act (for the stock exchange) and the Investment Act against compulsory acquisition. No investment can be expropriated unless Parliament has passed an act that relates to the compulsory acquisition of that property. In the event of expropriation, the 1993 Investment Act guarantees full compensation at market value and free transfer of the funds in the currency in which the investment was made. In December 1994, the Government announced that it would no longer participate in exploration or become a shareholder in a mining company and would limit its functions to regulatory or promotional activities. The Companies Act (1994) has brought Zambia's company law in line with modern United Kingdom company law. The Mines and Minerals Act of 1995, which was passed by Parliament as 1995 Act No. 31 on September 13, 1995, was aimed at attracting risk capital, technology, and entrepreneurial efforts to the mining sector. The Act officially put in place a mineral policy that called for a privatization program to encourage private development and diversification of the mining sector. The Act commits the Government to the promotion of small-scale mining; to the development of gemstone mining and liberalization of gemstone marketing facilities; to the diversification of mining through development of industrial, ferrous, and energy minerals; to the reduction of ecological damage arising from mining; and to the promotion of local value-added processing of Zambia's mineral raw materials. The law covers all mineral commodities and treats large-scale, small-scale, and gemstone operations

[1]Where necessary, values have been converted from Zambian kwacha (K) to U.S. dollars at the rate of K3,573=US$1.00 for 2001 and K3,225=US$1.00 for 2000.

[2]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

separately as to mineral rights (prospecting and mining authorizations). Export of radioactive minerals, such as monazite, is illegal without special Ministerial approval. It also gives the Government leeway in negotiating individualized contracts with investors. Among other provisions were secure title to mining rights with provision to assign, the right to market products, international arbitration, exemption from import duties and sales taxes on material at least for an initial period of exploration and development, and royalty charges of 3% for large-scale mining license holders on the "net back value" of minerals free-on-board, less transport and smelting and refining costs. By 2000, privatization of most of the major mines had been completed, and efforts were ongoing to privatize the gemstone and other small mines sector and to attract foreign investors to develop other known metallic and industrial mineral resources.

Environment

Parliament's Environmental Protection and Pollution Control Act (No. 12) of 1990 is the basis for the formation of the Ministry of Environment and Natural Resources and the Environmental Council of Zambia. The Act, which formally came into full force in February 1992, gave the Ministry overall responsibility for protecting the environment. In March 1997, the Mines and Minerals (Environmental) Regulations were passed to implement environmental protection provisions of the Mines and Minerals Act of 1995. The 1997 environmental legislation established an environmental protection fund and regulations for environmental impact assessments, mine dumps, air and water quality, and emission.

During 2001, a World Bank proposal to fund a $40 million Copper Belt environmental project to be implemented by the Government and Zambia Consolidated Copper Mines-Investments Holdings Plc. (ZCCM-IH) continued along its assessment and approval process. The project was scheduled for World Bank board approval in June 2002. It would be used to help ZCCM-IH address the environmental liabilities and obligations assumed by the Government after the privatization of Zambia Consolidated Copper Mines (ZCCM) assets. ZCCM-IH held a minority (10%-20%) interest in the respective newly privatized mining companies. The project was designed to develop an environmental management plan (EMP) and an environmental mitigation fund to strengthen the Government's capacity to monitor adequately the implementation of the EMP (World Bank, 2002§).

Production and Trade

In the copper sector, 2001 was the first full year of production under the new private ownership, with the Bank of Zambia (BOZ) reporting the production of 296,446 metric tons (t) of copper and 4,657 t of cobalt and exports of 296,387 t of copper and 4,380 t of cobalt (Bank of Zambia, 2002§). The BOZ data for copper, however, differ somewhat from the data in table 1, which are derived from the International Copper Study Group. Copper and cobalt exports were valued at about $590 million. In general, the copper and cobalt production shows the results of new investment during 2000 and 2001—production of copper up by 17% to 30% depending on the stage, and that of refined cobalt, up by 39% compared with those of 2000. With the closure of the Dunrobin gold mine at the end of 2000, gold production was limited to byproduct production from copper refining and dropped by an estimated 78% in 2001. Production data for many industrial minerals are not reported and have been estimated at a constant level for the past 5 years. Zambia was a major world supplier of amethyst and emerald and also produced gemstone-quality aquamarine, garnet, and tourmaline. Most gemstone mining was done by small-scale artisanal miners, and production and export levels were poorly documented. Emerald production has been largely undocumented, but based on output from the major producer, around 7,000 kilograms per year (kg/yr) of emeralds has been produced with a value estimated to exceed $200 million.

Chilanga Cement plc, which was the country's only cement producer, maintained cement production at around 350,000 metric tons per year (t/yr). The Maamba coal mine had returned production to the 150,000-to-180,000-t/yr range following the 1997 flooding of the mine and was back on the list for privatization.

More than one-half of copper and cobalt exports went to Asia and Europe. Bulk copper was exported via rail from Zambia to the Tanzanian port of Dar es Salaam via the Mozambican port of Beira and through the South African ports of East London and Durban. The principal import was petroleum, which included crude and refined products. The Arabian Gulf states were the principal sources of oil imports, and South Africa was also a major source at least partly because of transhipments from overseas sources. Fertilizer components, particularly phosphorus and potassium, were the second largest mineral import.

Commodity Review

Metals

Copper and Cobalt.—Following the completion of the privatization of ZCCM in 2000, 2001 was a year of optimism for Zambia because much needed new capital flowed into mine and plant rehabilitation and production reversed its long downward trend. Compared with other producing mines, like those in Chile and the United States, however, Zambian mines had relatively high operating costs. In addition, the Zambian industry was struggling with low world cobalt commodity prices and with copper commodity prices that were at a 70-year low in constant dollar terms. Cobalt is produced as a coproduct of copper mining and processing. In January 2002, redevelopment plans for the Zambian copper industry had a major setback when Anglo American plc, which owned Zambia Copper Investments Limited (ZCI), announced that it would write off $350 million in losses at KCM and cease operations within 12 months if the sale or transfer of KCM's assets on a going-concern basis could not be arranged. KCM was owned by ZCI (65%), the Government (through ZCCM) (20%), the World Bank's International Finance Corporation (7.5%), and Commonwealth Development Corporation Group Plc (7.5%) and employed 10,000 people. ZCI reported losses of $108 million from its takeover of the mines from March 2000 to

Digitized by Google

December 2001 and said it was unable to obtain external financing "on normal commercial terms" for the more than $1 billion needed to develop the Konkola Deep Mine Project (KDMP). The existing mines at KCM have a relatively short remaining life, and the longer term prospects for KCM were dependent on development of the KDMP. Anglo American also informed ZCI that it would honor its existing funding commitments to provide ZCI with up to $310 million for on-lending to KCM for debt payment and other ongoing obligations. As of December 31, 2001, Anglo American had already lent ZCI $214 million of this amount (Anglo American plc, 2002§). The Government and the other KCM partners will spend the remainder of 2002 examining options for selling or transferring the assets of KCM to another party or for closure in a socially and environmentally responsible manner. A detailed list of KCM's remaining geologic assets is in table 3.

Operationally during 2001, KCM spent $178 million on the refurbishment of mine assets, which included rehabilitation of the tailings leach plant. Production increased by 18% to 196,805 t of refined copper and 2,422 t of refined cobalt in 2001, but the increase was lower than the planned target owing to problems at the toll smelter at Nkana and to a major accident at the Nchanga open pit. On April 8, a slope failure caused the movement of 5 million metric tons (Mt) of material that killed 10 workers and took the Nchanga pit out of production for 1 month. The future economics of open pit mining at Nchanga were being reevaluated. KCM began a major dewatering program after the slope failure, which also required the removal of an extra 28 Mt of material. The Smelterco smelter at Nkana was shut down for a 2-month overhaul, but intermittent problems with the oxygen plant continued to constrain output and led to a build up of 20,000 t of copper concentrates that will be treated in 2002. For 2001, the Nchanga open pit mined 4.4 Mt of copper ore at a grade of 2.21% and 1.1 Mt of cobalt ore at a grade of 0.6% cobalt. The Nchanga underground block cave mine produced 2.9 Mt of ore at a grade of 3.25% copper. Mine production at KCM's third copper mine at Konkola underground was 1.8 Mt at a grade of 3.29% copper. Deteriorating ground conditions and several seismic events kept new underground development work at Konkola below target levels. The Konkola and the Nchanga concentrators treated 9.2 Mt of ore at an average grade of 2.66% copper, which yielded 138,310 t of copper in concentrates. An additional 794,000 t of cobalt ore was treated, which yielded 3,272 t of cobalt in concentrates. Finished copper production at the tailings leach plant was 76,851 t. KCM sent its concentrates to Smelterco for toll smelting at the Nkana smelter and to Mopani Copper Mines plc's Mufalira smelter. The smelters were being rehabilitated to address several operating problems, stoppages, and concentrate inventory buildup in 2001 (Chadwick, 2002; Zambia Copper Investments Limited, 2002§).

As of December 31, 2000, KCM had estimated proved and probable copper reserves of 372.9 Mt at an average grade of 1.83% and cobalt reserves of 3.3 Mt at an average grade of 0.37% cobalt. Total contained copper in these reserves amounted to 6,822,000 t, of which 51% was located in the KDMP, and 17%, in the Nchanga CRO (refractory ore) waste dump (Zambia Copper Investments Limited, 2001§).

Mopani was owned by the privately owned Swiss metals trading company Glencore International AG (46%), First Quantum Minerals Ltd. (44%) of Canada, and ZCCM-IH (10%). In an equity-for-debt swap with Glencore in April 2002, First Quantum reduced its interest in Mopani to 16.9%; Glencore's equity increased to 73.1% (First Quantum Minerals Ltd., 2002, p. 4). First Quantum also owned (100%) and operated the Bwana Mkubwa Mine near Ndola and held the rights to develop the Kansanshi copper deposit near Solwezi.

Mopani operated the Mufalira copper mine, mill, smelter, and refinery and the Nkana mill and cobalt plant. For the year ending November 30, 2001, Mopani produced 108,000 t of refined copper and 1,700 t of refined cobalt. With London Metal Exchange (LME) copper cathode prices for 2001 averaging $0.72 per pound, First Quantum reported Mopani's total costs at $0.94 per pound of copper and operating cash costs at $0.78 per pound of copper, net of credits. Owing to a variety of technical and market factors, Mopani underperformed for the year, and its efforts to revitalize the operations were behind schedule. The need for basic maintenance and the resupply of equipment that resulted from ZCCM's lack of capital investment in maintenance in recent years contributed to the problem. Mopani's Mufalira Division treated 1.93 Mt of ore at a grade of 2.29% copper that yielded 37,343 t of copper. The Nkana Division treated 3.13 Mt of ore at a grade of 1.73% copper and 0.14% cobalt that yielded 45,818 t of copper and 1,780 t of cobalt. Exploration drilling during 2001 demonstrated the potential to expand Nkana resources in the Mindola and Synclinorium ore bodies. Mopani reported resources as of November 30, 2001, as follows: the Mufalira Division had 22.53 Mt of reserves at an average grade of 3.01% copper and an additional indicated resource of 42.4 Mt at an average grade of 3.0% copper, and the Nkana Division had 69.24 Mt of reserves at an average grade of 2.24% copper and 0.14% cobalt and an additional indicated resource of 265.8 Mt at an average grade of 2.14% copper and 0.12% cobalt (First Quantum Minerals Ltd., 2002, p. 18-19).

During 2001, First Quantum's Bwana Mkubwa operation treated more than 1.89 Mt of tailings in its solvent extraction-electrowinning (SX-EW) circuit; this yielded 12,774 t of copper compared with 10,025 t in 2000. The SX-EW plant also generated 62,783 t of excess sulfuric acid for sale to other Copper Belt operations. The company reported remaining reserves of tailings at Bwana Mkubwa of 2.11 Mt at a grade of 0.77%; this represented about 1 year's plant feed. The life of the plant was being extended to treat ore from the newly discovered Lonshi deposit, which is located across the border in Congo (Kinshasa) about 36 kilometers (km) southeast of Bwana Mkubwa. During 2001, the newly constructed second acid plant at Bwana Mkubwa increased sulfuric acid production capacity to 145,000 t/yr from 110,000 t/yr. Early in 2002, Phase I expansion of the Bwana Mkubwa SX-EW plant, which included installation of crushing, milling, and preleach filtration facilities designed to treat the high-grade (5.75% copper) Lonshi ore, was completed. Phase II construction, which was scheduled for completion in late 2002, will expand overall production capacity to 30,000 t/yr of copper from its 10,000-t/yr level in 2000 (First Quantum Minerals Ltd., 2002, p. 18-19).

Digitized by Google

Having reduced its equity position in Mopani, First Quantum's corporate strategy appeared to be shifting to an emphasis on new greenfield developments, which included the former ZCCM mine at Kansanshi that closed in 1998. First Quantum acquired an 80% interest in Kansanshi in the May 2000 purchase of the exploration portfolio of Cyprus Amax Zambia (Cymax) from Phelps Dodge Exploration Corp. The reassessment of the deposit since 1998 by Cymax has identified resources of 267 Mt at an average grade of 1.28% copper and 0.16 gram per metric ton (g/t) gold at Kansanshi. A bankable feasibility study of Kansanshi was expected to be completed by late 2002. The study was geared to bringing an open pit mine into production in 2004 at an initial capacity of 75,000 t/yr of copper at an estimated capital cost of $120 million (First Quantum Minerals Ltd. 2002, p. 5, 14-15).

Chibuluma Mines Plc (controlled by Metorex Ltd. of South Africa since late 1997) owned and operated the Chibuluma West Mine near Kalulushi and the Chibuluma South Mine 12 km south of Chibuluma West. Crew Development Corp. of Canada held a 21% majority shareholder interest in Metorex. The Chibuluma West Mine, which has been in operation for 40 years, operated at a rate of 300,000 t/yr of ore, which was railed to the Nkana concentrator and the Smelterco smelter complex where approximately 7,900 t/yr of copper cathode and 990 t/yr of cobalt metal were produced. Efforts were being made to expand production for 2002. As of June 30, 2001, Chibuluma West had about 3 years of reserves remaining, which included proven and probable mineral reserves of 504,000 t at an average grade of 3.8% copper and 0.1% cobalt plus indicated and inferred mineral resources at Chibuluma West and 1.73 Mt at an average grade of 3.0% copper and 0.1% cobalt at the Chifuou Prospect (Crew Development Corp., 2001§).

Metorex's $12 million Chibuluma South Project was short-lived in 2001. Metorex commissioned the open pit mine and metallurgical plant in July but then placed operations on a care-and-maintenance suspension on September 28 because of continuing low metal prices and high operating costs in Zambia. The high cost of operating the cement copper circuit was singled out as one of the main factors in the decision. The company took a $10 million writeoff on Chibuluma South for 2001. Proved mineral reserves at Chibuluma South were 7.3 Mt at a grade of 3.7% copper at a cutoff grade of 1% copper. The open pit mine was designed to produce 40,000 t/yr of ore and 16,500 t/yr of copper along with byproduct cobalt during a 15-year mine life. A deeper sulfide ore body was also available for future underground development at Chibuluma South, which could double its copper production capacity (Chadwick, 2002, p. 66; Crew Development Corp., 2001§).

During 2001, NFC Africa Mining Plc. continued development work and purchase of new mining equipment for its $200 million Chambishi Mine Project. NFC Africa Mining, which was acquired from ZCCM in June 1998 for $20 million, was owned by the Chinese parastatal China Nonferrous Materials Industry Engineering and Construction Group (85%) and ZCCM-IH (15%). Mineral resources were estimated by ZCCM to be 136 Mt at a grade of 2.4% copper. Rehabilitation work on the underground mine and surface facilities started in July 2000 and was initially scheduled for completion and start up of mining by the end of 2002 with full operational capacity to be reached by 2003. NFC Africa Mining will mine 2.15 million metric tons per year (Mt/yr) of ore at Chambishi by using a combination of cut and fill and sublevel stoping. The mill will produce 120,000 t/yr of copper concentrates that average 40% copper. Chambishi ore reserves were reported to be 33 Mt with additional resources of more than 100 Mt. Production of 45,000 t/yr of copper was expected. The project investment will help China meet its growing need for copper imports (Chadwick, 2002, p. 67; Atlas Copco, 2000§; China Government, [undated]§).

Chambishi Metals plc. [owned by Angolvaal Mining Ltd. (Avmin) (90%) of South Africa] purchased the Chambishi cobalt plant and the Nkana slag dumps from ZCCM in August 1998 for $50 million and made a commitment to invest $140 million within 3 years. The leach plant, the zinc solvent extraction, and the cobalt tankhouse expansions were all completed by 2001 and were ready to accept material from the smelter. The $100 million Nkana slag-processing facility, which was referred to as the cobalt slag and copper as a byproduct facility (COSAC), was expected to begin production by early 2001. The COSAC plant was designed to blend, smelt, leach, and electrowin the Nkana slag dump material, which will be trucked in about 35 km to the plant. Avmin reported proven and probable reserves of Nkana slags at 19.86 Mt at an average grade of 0.73% cobalt and 1.09% copper plus an indicated resource of 1 Mt at an average grade of 0.86% cobalt and 1.11% copper (Anglovaal Mining Ltd., 2001a§, b§). Production was expected to reach 4,000 t/yr of cobalt and 7,000 t/yr of copper by mid-2001; technical problems, however, were encountered during startup. The new plant was commissioned during the third quarter of the financial year. During startup, however, water leaked under the magnesite lining, which resulted in hydration of the magnesite refractory bricks. Rebricking of the furnace was continuing into 2002, and reheating of the furnace was expected by July 2002. Full production in the expanded facility was now expected during the third quarter of the 2002 calendar year. Actual production during calendar year 2001 was chiefly limited to toll processing of materials from other Copper Belt operators at the old Chambishi cobalt roast-leach-electrowinning plant and acid plant and amounted to 4,200 t of cobalt and 16,400 t of copper; of these totals, 800 t of cobalt and 640 t of copper were for Avmin's own account (Anglovaal Mining Ltd., 2002b§). Pyrite needed to maintain sulfur levels in the roaster was obtained from KCM's Napundwe Mine, and lime was supplied by the Ndola Lime Co. Ltd. Power to the operation was supplied by Copperbelt Electric Company but was subject to periodic outages. Finished broken cobalt cathode was trucked to the port of Durban for export to Asia, Europe, and the United States.

In January 2002, Avmin announced that it was taking a $176 million partial write-down of the Chambishi Metals Plc asset as a result of the technical startup problems, large operating cost losses, and the decline in cobalt prices to $7.00 per pound from $10 per pound. A residual value of $70 million remained in Chambishi Metals, and Avmin stated its commitment to the remaining work on the project and to reaching full production by yearend 2002 (Anglovaal Mining Ltd., 2002a§).

Digitized by Google

In October 2001, Equinox Resources Ltd. of Australia began a $14 million bankable feasibility study designed to support the financing and development of the Lumwana Copper Project about 230 km west of the Copper Belt in northwestern Zambia. It was expected to be completed by mid-2003. The lack of regional infrastructure, which included electric power and transportation routes, was a constraint on the project; with assistance from the U.S. Trade and Development Agency, the Zambian Government, however, was studying infrastructure development options. As a result of a 1999 agreement with Phelps Dodge, Equinox was earning a 50% interest in the Lumwana Project from Phelps Dodge by spending $5 million during 4 years and up to 75% equity interest by covering up to $35 million of project costs during 12 years. The Lumwana Project contains two large copper-cobalt-gold-uranium deposits at Chimiwunga and Malundwe. Lumwana resources were reported to be more than 1 billion metric tons, which contain 0.67% copper using a 0.2% copper cutoff and 481 Mt of ore at a grade of 1.0% copper using a 0.6% copper cutoff grade. The mine feasibility study was based on a mining rate of 14.5 Mt/yr of ore during a 20-year mine life. Conventional milling and flotation was being considered to produce a copper-cobalt concentrate at a grade of approximately 34% copper with potential gold credits; an alternative roast-leach/SX-EW process, however, will also be considered. The open pit operation would produce 102,000 t/yr of copper from years 2 to 20 and 38,000 t/yr from years 21 to 24 and 1,900 t/yr cobalt from years 6 to 24. Between years 2 and 6, more than 3,365 kilograms of gold and 3,600 t of uranium oxide could be recovered. A 2000 prefeasibility study estimated capital costs to be $340 million (Equinox Resources Ltd., 2001§).

Zambezi Joint Venture (a separate venture between Anglo American and Equinox) was exploring for iron oxide copper-gold and Copper Belt copper-cobalt targets in the Kitwe and the Luanshya South areas, in the Kasanka and the Serenjie tenements in eastern Zambia, and on the Mwombehzi Dome tenement adjacent to Lumwana in northwestern Zambia. Anglo American, which was the operator, has reduced the concession area to 21,000 km^2 from 60,000 km^2 since 1997 and was focusing detailed exploration in 2001 and 2002 on copper mineralization identified at the Ndola West Prospect and on copper-cobalt-gold-uranium mineralization found at the Nyunga Prospect on the Mwombezhi Dome (Equinox Resources Ltd., 2001§).

In January 2002, Orion Mining Plc (owned by South African, Swiss, and German investors) closed its cobalt processing plant, which was located near the old Kabwe zinc mine. Orion had bought the plant from Colossal Resources Corp. of Canada in 2000. As a result of low cobalt prices, it could not justify needed plant refurbishment. It processed between 2,500 and 3,000 t/yr of cobalt solely from material imported from Congo (Kinshasa) (Reuters, 2002§).

Zinc.—In late 2001, Sable Zinc was founded by former ZCCM employees with support from Commonwealth Development Corp. and the European Investment Bank-Barclays to retreat tailings from the historic Kabwe zinc mine. The $3.5 million project included construction of a leach plant to treat a blend of washing plant slimes and sand and tailing leach residue with a grade of 10% zinc at a rate of 80,000 t/yr. Plans were to recover 32,000 t of zinc during an initial period of 8 years. The business plan for the project was based on a minimum zinc price of more than $900 per metric ton. The average LME zinc price for 2001 was approximately $926 per ton (African Mining, 2001§).

Industrial Minerals

Cement—Chilanga Cement operated cement plants at Lusaka and Ndola on the Copper Belt with capacities rated at 207,000 t/yr and 310,000 t/yr, respectively. Chilanga also had the capacity to produce 441,000 t/yr of clinker. The company sold more than 10% of its annual production to Copper Belt mines and maintained export markets to Malawi and other neighboring countries. In mid-2001, the largest cement producer in the world Lafarge of France bought Pan African Cement Group, which had controlling stakes in the following significant African cement businesses: Chilanga Cement of Zambia, Portland Cement Company of Malawi, and Mbeya Cement Company of Tanzania. LaFarge owned 51.1% of Chilanga Cement (Lewis Mwanangombe, 2001§).

Gemstones.—Zambia produced a range of semiprecious colored gemstones, which included amethyst, aquamarine, emerald, garnet, morganite, and tourmaline; of these, emerald was, by far, the most important (Africa InSites, undated§). Zambia, along with Brazil and Colombia, was the major source of high-quality natural emeralds in the world, and although exports were not well documented, the value of Zambian production and exports was estimated to be more than $200 million per year. A 1998 assessment estimated production to be around 7,000 kg/yr of emeralds with approximately 3% appraised as top grade and valued at more than $500 per carat. An additional 37% was appraised as gemstone quality and valued at $20 to $500 per carat. Low-grade emerald is sold for use in making synthetic emeralds. Fines are sold in India for use in the decorative arts. Zambian emerald rough is sent to Israel or Sri Lanka for cutting, although the Government is promoting the establishment of value-added cutting industry in the country (Lamprecht, 1998§).

Nearly all emerald production comes from within the Ndola Rural Protected Area. The Government-controlled area is roughly 30 by 50 km in area and is located about 40 km west of the Copper Belt town of Kitwe. More than 500 mining licenses have been issued in the area, nearly all to artisanal miners. Mining is intermittent with most activity carried out during the dry season. Production is constrained by the lack of capital and equipment available to the artisanal miners. The cash-poor artisanal miners usually sell their rough stones as they are found to middlemen from India and West Africa (Mali, Nigeria, and Senegal). A few medium-scale mining operations existed; the largest of these was Kagem Minerals Ltd. [owned by the Government (55%) and by an Indian-Israeli joint-venture company (45%)]. By using 3-cubic-meter bucket excavators and 35-t haul trucks, Kagem mined about 35,000 metric tons per month (t/mo) of ore, which yielded about 50 kilograms per

Digitized by Google

month of rough emerald. Emerald mineralization occurs within two stages of intrusive pegmatite dikes and within Precambrian ultramafic rocks metamorphosed to a tremolite-chlorite-magnetite schist. A biotite-phlogopite alteration zone at the contact between the schist and the pegmatite is further enriched in emeralds. Structural traps, which include shearing and folding, play a further role in concentrating the emerald mineralization. Bulk mining was used at Kagem; ore below the weathered zone was blasted, crushed, washed, and sorted at the expense of some loss of emerald crystals. Beryl and emerald rough stones down to -4–millimeter fines were marketed. Sorting and grading was done onsite in a high security facility. Kagem production was sold at auction every 3 months.

The Zambia Privatization Agency (ZPA) had invited offers to purchase the 87% shareholding held by the Government (50%) and Lonrho Africa Limited (50%) in Kariba Minerals Ltd. (KML), which was a producer of amethyst and tourmaline. The closing date for bids was October 6, 2000. KML was acquired by Gemhouse Inc. of Canada in 2001 (Gemhouse Inc., 2002§; Zambia Privatization Agency, 2000§).

Caledonia Mining Corp. had a joint venture with BHP World Exploration Inc. and Motapa Diamonds Inc. (its affiliate company) to explore the Mulonga Plain, Kashiji Plain, and Kakenge River licences in western Zambia for diamond. During 2001, BHP earned its 60% interest in the joint venture by completing its initial $3 million in exploration. BHP can increase its interest to 75% with completion of a feasibility study. A 10- to 20-hole drilling program was scheduled for 2002 (Caledonia Mining Corp., 2002§)

Mineral Fuels

Coal.—In 1997, Benicon Limited of South Africa purchased an 80% interest in the country's only coal mine, Maamba Collieries Ltd., under the Government privatization program. In the succeeding years, however, Benicon was faced with limited markets, floods, and other operational problems. During 2000, the mine produced at a rate of only 14,000 t/mo, which was equivalent to only 20% to 25% capacity utilization. With the failure of Benicon to meet a final deadline in August 2000 to make the last $1.5 million purchase payment on the mine, however, the Government rescinded its agreement with Benicon and repossessed the mine. Remaining proven coal reserves were estimated to be more than 60 Mt (Mwanangombe, 2000§). Maamba Collieries was offered for sale again by the ZPA in 2001, and a bid was made by Kuyasa Mining of South Africa. Having experienced several reversals of investments under the privatization program, which included with Benicon, Binani Group, and Anglo American on KCM, the ZPA was proceeding cautiously with the approval of the Maamba sale to Kuyasa, which was still pending in early 2002 (Times of Zambia, 2002§).

Infrastructure

As a landlocked country, Zambia was dependent on truck and rail transport to sustain most of its economy. The truck road and railway networks within the country and externally were reasonably adequate for access to ocean and lake ports for international trade. Major highways generally paralleled the rail lines. About 20% of the main roads was paved, and about 20% was gravel or stabilized earth. The principal rail routes were northeast to and from the Port of Dar es Salaam, which was nearly 2,000 km from Ndola in the Copper Belt, mostly on the Tanzania Zambia Railways Authority (Tazara) line and south through Zimbabwe to and from South African ports, which are more than 2,500 km from Ndola, on the Zambia Railways Ltd. line in Zambia. The roughly 2,000-km rail link southeast through Zimbabwe to the Port of Beira was now more accessible following post-civil-war refurbishment of rail and port facilities in Mozambique. The more-than-2,200-km rail link north into Congo (Kinshasa) and west to the Port of Benguela (Lobito), Angola, has remained unavailable during the 20-year civil war in Angola. A crude oil pipeline that ran about 1,700 km southeast from Dar es Salaam to a refinery in Ndola, was owned and operated by Tazama Pipelines Ltd. (a joint venture of the Zambian and the Tanzanian Governments).

Essentially all Zambia's 8.16-billion-kilowatthour energy production in 2000 was from hydroelectric sources.

Outlook

Despite the relatively successful completion of the privatization of the copper-cobalt sector in 2000, high operating costs at the older facilities and historically low world copper and cobalt commodity prices began to threaten the viability of the metal mining sector of the Zambian economy by early 2002. As much as 500,000 to 600,000 t/yr of existing or planned new copper capacity, and the accompanying investment could be canceled or postponed by 2002. A revised U.S. Geological Survey forecast of Zambian copper production for 2008 suggests a production level of about 425,000 t/yr of copper in Zambia by 2008 plus an additional 100,000 t/yr of copper if the Kansanshi project proceeds. A turn-around in this scenario requires rapid recovery in the global economy and renewed demand for copper and cobalt and a successful turnover of KCM assets from Anglo American to a new owner/operator. Future growth in copper capacity is most likely to come from development of new greenfield projects, such as those at Kansanshi and Lumwana. Development of deeper resources at Konkola and Mufalira will require sustained higher commodity prices to justify the high development and cooling costs of mining at depth and under the high geothermal gradients that exist in the Copper Belt.

The country faced several internal and external hurdles to development, which included high transportation costs; limited infrastructure, particularly west of the Copper Belt; the threat that high HIV/AIDS rates in the region posed on maintaining a skilled labor force; and cyclical world commodity prices. On the positive side, the apparent end of civil wars in neighboring Angola and Congo (Kinshasa) is expected to help reduce the political risk of financing new projects. Stabilization of all or some of these factors will be needed for the country to attract new foreign investment and technology. Restructuring of the gemstone sector and efforts to manage the export flow of gemstones better also has the potential to generate a larger value-added industry in Zambia.

Digitized by Google

References Cited

Chadwick, John, 2002, The Zambian Copperbelt: Mining Magazine, v. 186, no. 2, February, p. 64-80.

First Quantum Minerals Ltd., 2002, 2001 annual report: Vancouver, British Columbia, Canada, First Quantum Minerals Ltd., April 22, 50 p.

Internet References Cited

Africa InSites, [undated], Zambia gemstones—A buyers guide, accessed May 2, 2001, at URL http://www.africa-insites.com/zambia/info/General/gemstones.htm.

African Mining, 2001 (July-August), Retreatment project at historic Kabwe, African Mining, accessed September 1, 2002, at URL http://www.mining.co.za/DataResult.asp?IdNo136.

Anglo American plc, 2002 (January 24), Zambia Copper Investments Limited ("ZCI") concludes strategic review of its investment in the Konkola Copper Mine ("KCM") operations in Zambia, Press Release, accessed January 25, 2002, at URL http://www.angloamerican.co.uk/press/2002/24012002.asp.

Anglovaal Mining Ltd., 2001a, Mineral resources and reserves, Annual Report 2001, accessed August 28, 2002, at URL http://www.avmin.co.za/annualreport/avmin/2001/mineralresourceandreserves.asp.

Anglovaal Mining Ltd., 2001b, Review of operations—Base metals, Annual Report 2001, accessed August 28, 2002, at URL http://www.avmin.co.za/annualreport/avmin/2001/basemetals.asp

Anglovaal Mining Ltd., 2002a (January 29), Partial right-down [sic] of Avmin's Chambishi Metals assets, Press Release, accessed August 28, 2002, at URL http://www.avmin.co.za/mediashop/pressrelease.asp?story=65.

Anglovaal Mining Ltd., 2002b, Results for the half-year ended 31 December 2001, accessed August 28, 2002, at URL http://www.avmin.co.za/investor/reports.asp.

Atlas Copco, 2000 (December 11), Major rig order for new copper mine venture in Zambia, Mining and Construction Online, accessed May 2, 2001, at URL http://www.miningandconstruction.com/news/news23.htm.

Bank of Zambia, 2002, Mineral production and exports, accessed August 9, 2002, at URL http://www.boz.zm/Economics/Fortnightly/2002-07-19/mineral_production_and_ecports.htm.

Caledonia Mining Corp., 2002 (March 31), Financial information, Annual Report for 2001, accessed August 12, 2002, at URL http://www.caledoniamining.com/welcome2.html.

China Government, [undated], Bank digs deep for mining loan, accessed April 30, 2001, at URL http://www.mlr.gov.cn/english/Bank%20digs%20deep%20for%20mining%20loan.html.

Crew Development Corp., 2001, Operations—Chibuluma Mines Plc., accessed August 28, 2002, at URL http://www.crewgroup.com/operations.html.

Equinox Resources Ltd., 2001 (September), Annual report for year ended June 30, 2001, accessed August May 22, 2002, at URL http://www.eqr.com.au/investor.asp.

Gemhouse Inc, 2002, Kariba Minerals Ltd., accessed September 2, 2002, at URL http://www.gemhouseonline.com/ygemhouse/about.jsp.

International Monetary Fund, 2002 (March), Zambia—Poverty reduction strategy paper, accessed August 13, 2002, at URL http://www.imf.org/external/np/prsp/2002/zmb/01/index.htm.

Lamprecht, Corrie, 1998 (June 12), Emerald Mine Investment Centre, accessed February 28, 2002, at URL http://members.tripod.com/~emeraldmine/returns.htm.

Mwanangombe, Lewis, 2000 (November 30), Zambia ends coal mine deal due to irregularities, Panafrican News Agency, accessed May 22, 2001, at URL http://allafrica.com/stories/200011300009.html.

Mwanangombe, Lewis, 2001 (April 5), Africa's big cement company wins take-over bid, Panafrican News Agency, accessed August 12, 2002, at URL http://allafrica.com/stories/printable/200104050202.html.

Reuters, January 28, 2002, Kabwe cobalt plant to shut in new blow to Zambia, accessed May 5, 2002, at URL http://allafrica.com/stories/200201280455.html.

Times of Zambia, 2002 (March 1), Maamba sale awaits, accessed August 12, 2002, at URL http://allafrica.com/stories/200203010158.html.

World Bank, 2002 (February 13), Zambia—Copperbelt environment project, Report P070962, accessed August 15, 2002, at URL http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000094946_02022104015671.

Zambia Copper Investments Limited, 2001 (March 1), Annual/interim reports, Annual Report 2000, accessed May 3, 2002, at URL http://www.zci.lu/annual_report2000.pdf.

Zambia Copper Investments Limited, 2002 (March 25), Annual/interim reports, Annual Report 2001, accessed May 3, 2002, at URL http://www.zci.lu/Annual_report_2001.pdf.

Zambia Privatization Agency, 2000, Kariba Minerals Ltd., accessed March 27, 2001, at URL http://zic.org.zm/kariba.htm.

Major Sources of Information

Zambia Investment Centre
5th Floor, Ndeke House
Haile Selassie Avenue
P.O. Box 34580
Lusaka, Zambia
Telephone: 260-1-252240
Fax: 260-1-252150
Internet: http://www.zic.org.zm

Zambian Privatization Agency
Privatization House
Nasser Road
P.O. Box 30819
Lusaka, Zambia
Telephone: 260-1-223858, 227735, 227791, 223859 or 238303
Fax: 260-1-227250
E-mail: zpa@zamnet.zm
Internet: http://www.zpa.org.zm

Ministry of Mines and Minerals Development
Permanent Secretary
P.O. Box 31969
Lusaka, Zambia
Telephone: 260-1-254107
Fax: 260-1-251224
Director, Mines Development Department
P.O. Box 31969
Lusaka, Zambia
Telephone: 260-1-251719
Fax: 260-1-252916
Director, Geological Survey Department
P.O. Box 50135
Lusaka, Zambia
Telephone: 260-1-251570
Fax: 260-1-251973

Zambian Consolidated Copper Mines—Investments Holdings Plc.
Mukuba Pension House
5309 Dedan Kimathi Road
P.O. Box 30048
Lusaka 10101, Zambia

Digitized by Google

TABLE 1
ZAMBIA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000	2001
METALS						
Cobalt: 2/						
Mine output, Co content		6,037	11,900	5,640	4,600	8,000 e/
Metal, Co content		4,403 r/	4,837 r/	4,236	3,342 2/	4,657 2/
Copper: 2/ 3/						
Mine output, Cu content:						
By concentration or cementation		288,900	258,000	213,000	184,100 r/	233,000
Leaching, electrowon		64,000	57,000	67,000 r/	65,000 r/	79,000
Total		352,900	315,000	280,000 r/	249,100 r/	312,000 2/
Metal:						
Smelter, primary:						
Electrowon, low grade		61,140	51,736	25,000	25,000	25,100
Other		220,327	206,871	217,600 r/	180,000 r/	215,000
Total		281,467	258,607	242,600 r/	205,000 r/	240,100
Refinery, primary:						
Electrowon		63,736	57,000 r/	67,000 r/	65,000 r/	79,000
Other		268,553	245,820	201,400 r/	162,400 r/	217,000
Total		332,289	302,820 r/	268,400 r/	227,400 r/	296,000
Gold 2/	kilograms	290 e/	765	700	600 e/	130 e/
Selenium, refined, gross weight 2/	do.	15,161	14,670	11,620 r/	9,370 e/	12,520 e/
Silver 2/	do.	6,684	8,363	5,840 r/ e/	4,710 e/	6,290 e/
INDUSTRIAL MINERALS						
Cement		384,000	351,000	300,000	380,000	350,000
Clays: e/						
Brick		3,000	3,000	3,000	3,000	3,000
Building (not further specified)		30,000	30,000	30,000	30,000	30,000
China and ball		200	200	200	200	200
Gemstones: e/						
Amethyst	kilograms	699,343	800,000	800,000	800,000	800,000
Beryl	do.	1,527	2,000	4,000 r/	4,000 r/	4,000
Emerald	do.	7,000	7,000	7,000	7,000	7,000
Garnet	do.	2,467	3,000	3,000	3,000	3,000
Tourmaline	do.	--	--	2,000 r/	2,000 r/	2,000
Gypsum e/		11,000	11,000	11,000	11,000	11,000
Lime, calcined e/	thousand tons	200	200	200	200	200
Limestone, for cement and lime e/	do.	800	800	800	800	800
Sand and gravel, construction e/	do.	200	200	200	200	200
Stone, construction: e/						
Limestone, crushed aggregate	do.	700	700	700	700	700
Other	do.	700	700	700	700	700
Sulfur:						
Gross weight:						
Pyrite concentrate		69,059	72,366	65,000	50,000	59,500
Sulfuric acid 4/		178,482	134,000	119,000	110,000 2/	63,000
Sulfur content:						
Pyrite concentrate (42%)		29,005 5/	30,394 5/	27,300	21,000	25,000
Sulfuric acid (32.6%)		58,185	43,684	38,800	35,800	20,500
Total, S content		87,190	74,078	66,100	56,800	45,500
Talc		44 r/	-- r/	-- r/	-- r/	--
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous e/		164,443 r/	185,717 r/	127,854 r/	168,000 2/	150,000
Petroleum, refinery products e/ 2/	thousand 42-gallon barrels	5,000	5,000	1,700	--	--

e/ Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. r/ Revised. -- Zero.

1/ Table includes data available through August 1, 2002.

2/ Data for 1996-99 are for year beginning April 1 of year stated. Calendar year data shown for 2000-01.

3/ Terms are used as defined by the International Copper Study Group.

4/ From Nkana and Chambishi acid recovery plants.

5/ Reported figure.

Digitized by Google

TABLE 2
ZAMBIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2001 1/

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity 2/
Cement	Chilanga Cement plc (Lafarge, 51%)	Lusaka Plant	207,000.
Do.	do.	Ndola Plant	310,000.
Coal	Maamba Collieries Ltd. [Kuyasa Mining (South Africa), 80%; Zambian Government, 20%]	350 kilometers south of Lusaka in Kanzie and Izuma Basins	800,000 bituminous coal, operating at 150,000 to 400,000.
Copper-cobalt	Konkola Copper Mines plc (KCM) [Zambia Copper Investments Ltd. (Anglo American plc) 65%; Zambia Consolidated Copper Mines (ZCCM), 20%; International Finance Corp., 7.5%; Commonwealth Development Corp. Group Plc, 7.5%]	Nchanga Open Pit	4,500,000 ore.
Do.	do.	Nchanga Underground Mine	2,800,000 ore.
Do.	do.	Nchanga Concentrator	88,000 copper in concentrate.
Do.	do.	do.	10,000 cobalt in concentrate.
Do.	do.	Nchanga Tailings Leach Plant	70,000 leach cathodes.
Do.	do.	Konkola Underground Mine	2,200,000 ore.
Do.	do.	Konkola Concentrator	50,000 copper in concentrate.
Do.	do.	Konkola Deep Mining Project	180,000 copper (planned).
Do.	Smelterco [Zambia Consolidated Copper Mines-Investment Holdings, Plc. (ZCCM-IH); KCM has option to buy]	Nkana Copper Smelter	450,000 blister/anode.
Do.	do.	Nkana Copper Refinery	236,000 blister/anode.
Do.	Mopani Copper Mines plc (Glencore International AG, 73.1%; First Quantum Minerals Ltd., 16.9%; ZCCM-IH, 10%]	Mufalira Mine	2,800,000 ore.
Do.	do.	Mufalira Concentrator	63,000 copper in concentrate.
Do.	do.	Mufalira Smelter	130,000 copper.
Do.	do.	Mufalira Refinery	150,000 copper.
Do.	do.	Nkana Mine	5,500,000 ore.
Do.	do.	Nkana Concentrator	45,000 copper in concentrate.
Do.	do.	do.	1,900 cobalt in concentrate.
Do.	do.	Nkana Cobalt Plant	2,500 cobalt, refined.
Do.	do.	do.	15,000 copper.
Do.	Anglovaal Mining Ltd. (Avmin) of South Africa, 80%; ZCCM-IH, 20%	Konkola North Project (exploration feasibility studies)	NA.
Do.	Chambishi Metals plc (Avmin, 90%; ZCCM-IH, 10%)	Chambishi Cobalt Plant	4,000 cobalt.
Do.	do.	Nkana Slag Dump (plant upgrade by 2001)	7,000 copper.
Do.	do.	UCHI tails retreatment plant	7,000,000 tailings feed.
Do.	First Quantum Minerals Ltd. (Canada), 100%	Bwana Mkubwa Mine; SX-EW plant treats Nkana tails and ore from Lonshi Mine, Congo (Kinshasa)	13,000 copper cathode, expanding to 30,000 copper by the end of 2002.
Do.	First Quantum Minerals Ltd., 80%; ZCCM-IH, 20%	Kansanshi Mine and environs (mine closed in 1998; feasibility study underway)	75,000 copper (2004 potential).
Do.	Chibuluma Mines Plc (Metorex Ltd., 85%; ZCCM, 15%)	Chibuluma West Mine (to close by 2003 or 2004)	450,000 ore.
Do.	do.	do.	8,400 contained copper.
Do.	do.	Chibuluma South Mine (commissioned July 2001; operations suspended September 2001)	16,500 copper.
Do.	ZCCM-IH, 100% (Roan Antelope Mining Corp. defaulted in 2000; ownership reverted to Government)	Luanshya Underground Mine	1,700,000 ore.
Do.	do.	Luanshya Concentrator	23,000 copper in concentrate.
Do.	do.	Baluba Underground Mine	1,400,000 ore.
Do.	do.	Baluba Concentrator	24,000 copper in concentrate
Do.	do.	do.	1,900 cobalt in concentrate.
Do.	do.	Luanshya Smelter (closed)	20,000.
Do.	do.	Mulashi North Project (planned)	34,000 copper.
Do.	do.	do.	1,400 cobalt.

See footnotes at end of table.

Digitized by Google

TABLE 2--Continued
ZAMBIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2001 1/

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity 2/
Copper-cobalt--Continued		NFC Africa Mining Plc. (China Non-Ferrous Metals Industries, 85%; ZCCM-IH, 15%)	Chambishi Mine (closed in 1987)	45,000 copper (planned when mine reopens in late 2002).
Do.		Lumwana Joint Venture [Phelps Dodge Corp. (United States), 100%; Equinox Resources Ltd. (Australia) can earn 50%-75% interest]	Lumwana deposit (exploration and prefeasibility work)	100,000 copper (potential).
Do.		Qasim Mining Enterprises Ltd. (Colossal Resources Corp. of Vancouver, British Columbia, Canada, 60%)	Kabwe Cobalt Tails Retreatment Plant (closed in 1999)	600 cobalt.
Do.		Orion Mining Plc	Kabwe Slag Processing Plant [to treat feed imported from Congo (Kinshasa)]	60,000 slag yielding 1,800 to 5,000 cobalt.
Gemstones: e/				
Amethyst	kilograms	Vantage Enterprises Corp. (Canada); and various artisanal operations	Krystal Mine in Kaloma; Mumbwa, near border with Zimbabwe	NA.
Do.	do.	Kariba Minerals Ltd. (Gemhouse Inc. of Canada)	Amethyst and tourmaline mine near Kariba	NA.
Aquamarine	do.	Various artisanal operations	Katete, Petauke areas	NA.
Beryl	do.	do.	Eastern Province pegmatites	NA.
Citrine	do.	do.	Iteshi Teshi; Mumbwa	NA.
Emeralds	do.	30 to 40 artisanal operations	Ndola Rural Protected Area, northwest of Kitwe	1,000 to 6,000. e/
Do.	do.	Kagem Minerals Ltd. (Government, 55%; Israeli-Indian Joint Venture, 45%)	Mine in Ndola Rural Protected Area, northwest of Kitwe	600.
Garnet	do.	Various artisanal operations	Eastern Province pegmatites, Mazabuka, Siavunga, Chikankata, Gwemba Valley	NA.
Tourmaline	do.	do.	Kalunga Wbeba Mine, Eastern Province	NA.
Do.	do.	do.	Hofmeyer Mine near Nyimba	NA.
Gold	do.	Reunion Mining plc (Anglo American plc, 100%)	Dunrobin Mine, 120 kilometers west of Lusaka (closed in late 2000)	600.
Do.	do.	Minerva (PMP) Ltd. [Binani Group (India), 100%]	Ndola Precious Metals Plant (processes copper refinery slimes)	150 refined gold.
Lime	metric tons per day	Ndola Lime Co. Ltd. [Socamer (Belgium)]	Ndola plants	1,000 limestone feed.
Do.		do.	Ndola kiln capacity	300,000 quicklime product.
Petroleum	42-gallon barrels	Zambia National Oil Co.	Indeni refinery at Ndola (damaged by fire in 1999)	8,950,000 refined products.
Selenium	kilograms	Minerva (PMP) Ltd. [Binani Group (India), 100%]	Ndola Precious Metals Plant (closed)	22,000 refined selenium.
Silver	do.	do.	do.	10,000 refined silver.
Sulfur: 2/		Konkoa Copper Mines plc	Nampundwe Pyrite Mine	79,000 pyrite.
Do.		do.	do.	33,000 contained sulfur.
Do.		Chambishi Metals plc (Avmin, 90%; ZCCM, 10%)	Chambishi Acid Plant	65,000 sulfuric acid.
Do.		do.	do.	21,190 contained sulfur.
Do.		Mopani Copper Mines plc	Nkana Acid Plant	120,000 sulfuric acid.
Do.		do.	do.	39,120 contained sulfur.
Do.		First Quantum Minerals Ltd. (Canada)	Bwana Mkubwa Acid Plant	110,000 sulfuric acid.
Do.		do.	do.	35,860 contained sulfur.
Zinc		Sable Zinc	Kabwe Mine tailings retreatment plant	4,000 zinc.

e/ Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. NA Not available.
1/ Includes data available through August 30, 2002.
2/ Some capacities shown are based on former Zambia Consolidated Copper Mines operations.

Digitized by Google

TABLE 3
ZAMBIA: RESERVES AND RESOURCES OF KONKOLA COPPER MINES PLC AS OF DECEMBER 31, 2000 1/

	Proved and probable reserves		Measured and indicated resources 2/	
	Quantity (million metric tons)	Grade (percentage of copper)	Quantity (million metric tons)	Grade (percentage of copper)
Copper ore:				
Konkola current mine 3/	16.2	3.58	1.6	2.81
Konkola Deep Mine Project	91.1	3.81	47.6	3.21
Nchanga open pit	13.4	2.31	16.3	1.62
Nchanga satellite pits	3.8	2.78	14.1	2.07
Nchanga underground	20.3	2.63	2.6	4.68
Nchanga refractory ore dumps	131.9	0.87	19.1	0.87
Nchanga tailings	95.4	0.69 4/	2.5	0.74 4/
		0.49 5/		0.55 5/
Transit stockpiles (copper)	0.8	1.66	2.7	1.06
Total 6/	372.9	1.83	106.5	2.31
Cobalt ore:				
Nchanga open pit	2.4	0.41	8.5	0.34
Nchanga satellite pits	--	--	0.4	0.23
Transit stockpiles (cobalt)	0.9	0.26	0.1	0.25
		1.16 4/		0.51 4/
Total 6/	3.3	0.37	9.1	0.33
Pyrite ore, Nampundwe pyrite mine	6.9	13.70	0.8	17.20

-- Zero.
1/ All reserves and resources have been classified in compliance with the South African Code for the Reporting of Mineral Resources and Reserves (SAMREC).
2/ Resources stated are in addition to the reserves.
3/ A negative adjustment of 0.491 metric tons needs to be made to the total Konkola reserve to account for overlaps and underlaps at the interface between the current mine and the Konkola Deep Mining Project.
4/ Percentage of total contained copper.
5/ Percentage of acid soluble copper.
6/ Indicates reserves and resources total.

Source: Zambia Copper Investments Limited, Annual Report 2000, p. 6.

Digitized by Google

Digitized by Google

THE MINERAL INDUSTRY OF

ZIMBABWE

By George J. Coakley

The Republic of Zimbabwe is a landlocked nation in southern Africa surrounded by Zambia to the north, Mozambique to the east, South Africa to the south, and Botswana to the west. It covers an area of 390,580 square kilometers (km^2) and supported a population of 11.4 million in 2001. For 2001, the gross domestic product (GDP) was $28 billion, and the per capita GDP was $2,450 based on 2001 purchasing power parity estimates. The real GDP growth rate for 2001 was -6.5%. The economy has suffered severely during the past 3 years. Causal factors included weak international commodity prices, the pegged exchange rate, limited capital availability, high inflation, and fuel and hard currency shortages. Although the official exchange rate has been fixed at 55 Zimbabwe dollars (Z$) equal to 1 U.S. dollar, the parallel market exchange rate has been as much as six times higher. The Government's commitment of military support to the civil war in the Democratic Republic of the Congo [Congo (Kinshasa)] also was a sizable drain on extremely scarce national resources. The state-sanctioned involuntary expropriation of commercial farm lands threatened to spill over to the mining sector and sharply increased the political risk component of any new foreign investment (U.S. State Department, 2000§[1]). A high foreign debt and difficulty in meeting debt service payments created further problems for the country as the World Bank placed Zimbabwe on nonpayment status in October 2000 and the International Monetary Fund removed it from the list of countries eligible to borrow resources under the Poverty Reduction and Growth Facility in September 2001 (International Monetary Fund, 2001§; World Bank, 2001§).

The mineral industry was diverse with more than 35 mineral commodities produced from more than 1,000 mines, mostly small. Although economic conditions during 2000 and 2001 forced many smaller mines to close. The total value of mineral production, which is based on the official exchange rate, was about $722.5 million[2] in 2001 with chromium and value-added ferroalloys accounting for 26.8%; gold, for 26.7%; nickel and cobalt, for 19.4%; coal, for 10.7%; asbestos, for 6.8%; and platinum group metals, for 4.8%. The actual current hard currency value of output, however, was estimated to be more realistically valued at about $300 million (Holloway, 2002). Gold was the most important commodity; output was valued at the official rate at approximately $193 million in 2001, which was down from $194 million in 2000 and $244 million in 1999 by value. The gold sector, which was the country's second largest export earner after tobacco, continued to suffer from the weakened economy and governmental policies, which included the Reserve Bank's announcement in June 2001 that it would increase its hard currency holdback of export proceeds to 40% from 25%. Production of gold declined to 18 metric tons (t) in 2001 compared with 27.7 t in 1999. The Reserve Bank hard currency restrictions also impacted other mining operations that produced commodity minerals that were fully exported, such as asbestos and chromium. Zimbabwe was a major contributor to the world supply of chrysotile asbestos, ferrochromium, and lithium minerals. Between 1999 and 2000, employment in the mining and quarrying sector declined to 45,000 workers from an estimated 60,000. During the political turmoil of 2001, about 20 mines, mostly gold and black granite, were temporarily occupied by "war veterans," and labor unrest led to several strike actions, the most serious being at the state-owned Zimbabwe Iron and Steel Company's (Ziscosteel) Kwekwe works (Holloway, 2002).

In addition to economic and political difficulties, Zimbabwe had one of the highest incidences of HIV/AIDS infection in the world; 33.7% of the adult population between 15 and 49 years old was infected by the end of 2001. This had a direct impact on the productivity of agricultural workers, which contributed to food shortages in the country. An estimated 200,000 deaths were attributed to AIDS in 2001, and since the beginning of the epidemic, more than 780,000 children have been orphaned (Joint United Nations Programme on HIV/AIDS, 2002§). The HIV/AIDS epidemic has had a significant impact on mining by adding substantially to direct and indirect labor costs as a result of absenteeism, lost productivity, medical treatment, and skill replacement.

Production and Trade

Between 2000 and 2001, production declined from -5% to more than -28% in the following major commodities: asbestos, blister and refined copper, diamond, gold, iron ore, lithium, and vermiculite (table 1). On the positive side, production increases of from 1% to 24% were noted in chromite, coal, cobalt, ferrochromium, nickel, platinum-group metals, and crude steel.

The International Monetary Fund estimated data for 2001 indicated that mineral and manufactured metal exports accounted for $482.2 million out of total exports of $1.72 billion for the year. Major exports included gold ($166.5 million), ferroalloys ($140.6 million), asbestos ($62.5 million), nickel ($37.6 million), and iron and steel ($4.6 million). The main export trade partners were, in order of importance, South Africa, China, the Netherlands, Japan, and Italy. Export earnings have been progressively declining since 1995 when a total of $736.6 million in minerals and manufactured metals

[1]References that inclue a section twist (§) are found in the Internet References Cited section.

[2]Where necessary, values have been converted from Zimbabwe dollars (Z$) to U.S. dollars at the average exchange rate of Z$54.95=US$1.00 in 2001 and Z$43.29=US$1.00 in 2000.

Digitized by Google

were exported, although this can be attributed in part to declining commodity prices during this period. In 2001, imports of electricity and fuels, which included petroleum products, were valued at $391.7 million, or 23% of total imports valued at $1.71 billion. On the basis of percentage of import trade, Zimbabwe's major trading partners were, in order of importance, South Africa, the United Kingdom, Japan, and Germany. South Africa supplied 48% of all imported goods (International Monetary Fund, 2002§).

Commodity Review

Metals

Copper.—Mhangura Copper Mines, which was owned by Zimbabwe Mining Development Corporation (ZMDC), closed its mine and smelter in late 2001 owing to high costs and a lack of copper concentrate feed for the smelter.

Ferroalloys.—Zimbabwe Alloys Mines Limited (ZimAlloys) closed its low-carbon ferrochrome production at Gweru in March 2001 and continued with its project to convert its Gweru smelter to high-carbon ferrochrome production. ZimAlloys, in which the Japanese companies Japan Metals and Chemicals Co. Ltd. and Mitsui and Co. Ltd. each held a 25% interest, operated the 40,000-t/yr low-carbon ferrochrome plant at Gweru.

Gold.—The gold sector was one of the most affected sectors of the industrial economy in 2001. All gold had to be sold to the central Reserve Bank of Zimbabwe with payment in local currency at a fixed rate, which was lower than the rate at which the companies could buy foreign exchange. This has put the gold sector at a disadvantage to other companies whose commodities can be exported for hard currency. Despite belated Government attempts during late 2001 to introduce a floor price for gold of Z$23,650 per ounce of gold (equivalent to $430 per ounce at the official exchange rate), about 40 significant gold mines had gone out of business by early 2002 (Holloway, 2002). These closures included the operations of Consolidated Trillion Resources Ltd., Delta Gold NL (now AurionGold NL.), Falcon Gold Ltd., and First Quantum Minerals Ltd.

Of the major gold producers in 2001, Ashanti Goldfields Co. Ltd. of Ghana, which was faced with some mechanical and operational problems, saw production decline to 3,193 kilograms (kg) of gold at the Freda-Rebecca Mine compared with 3,489 kg in 2000. Ashanti reported remaining measured and indicated mineral resources at the Freda-Rebecca Mine to be 15.1 million metric tons (Mt) at a grade of 2.5 grams per metric ton (g/t) gold, of which 5.4 Mt at a grade of 2.4 g/t gold was in the proved and probable ore reserve category (Ashanti Goldfields Co. Ltd., 2002§). Rio Tinto Zimbabwe (Pty) Ltd. produced 2,084 kg of gold in 2001 compared with 2,177 kg in 2000. Of the 2001 total, 75% came from the Renco Mine; 18% from the Patchway Mine; and 5% from reprocessing of the Cam Mine tailings dump. With the addition of new production from tailings reprocessing, Kinross Gold Corp. increased output at the Blanket Mine to 1,231 kg of gold in 2001 compared with 1,075 kg in 2000. Concerned with operating difficulties and foreign exchange restrictions, Kinross wrote down $12 million in assets of the Blanket Mine at yearend 2001 but was committed to keeping the mine open during 2002 (Kinross Gold Corp., 2002§).

Gold output at Independence Gold Ltd., which was owned by Lonmin plc., declined to 5,260 kg in 2001 from 5,889 kg in 2000. Independence Gold operated the Arcturus, the How, and the Shamva Mines; the Muriel Mine was closed in June 2001 (Lonmin plc, 2001§).

Cluff Mining plc operated the Maligreen gold deposit, which is located approximately 240 km southwest of Harare. During 2001, the Maligreen gold mine, which was a 50-50 joint venture with Pan African Mining, processed approximately 94,000 t of ore at a grade of 4.7 g/t; this yielded production of 388 kg of gold. The oxide operations were scheduled to cease in mid-2002 (Cluff Mining plc, 2002§).

Iron and Steel.—Production of crude steel at Ziscosteel operations decreased by 40% to 156,000 t in 2001 following a 3-day strike in August by 4,000 workers who were protesting for wage increases. The violent strike action led to the death of three workers and damaged the main blast furnace and other equipment, which took 3 months to return to operation. The Ziscosteel plant had the capacity to produce 800,000 metric tons per year (t/yr) of crude steel. Ziscosteel was also having problems paying its suppliers of coal (Wankie Colliery Co. Ltd.), iron ore (Buchwa Mine Iron Mining Co.), and electricity and transportation (Financial Gazette [Zimbabwe], 2001§).

Nickel.—Bindura Nickel Corp. (BNC), which was owned by Anglo American plc (52.9%), operated the Madziwa, the Shangani, and the Trojan nickel mines; a nickel smelter; and a nickel refinery. The Madziwa Mine was placed on a care-and-maintenance basis at yearend 2000; further exploration and evaluation continued in 2001. The Shangani Mine milled 961,000 t of ore at an average grade of 0.48% nickel; this yielded 3,388 t of nickel contained in concentrates. Flooding of the mine early in the year affected production. A new subincline shaft at the Shangani Mine was scheduled for commissioning during the first half of 2002. During 2001, the Trojan Mine milled 989,000 t of ore at an average grade of 0.62% nickel; this yielded 4,358 t of nickel contained in concentrates. The outputs represented increases during 2000 as the Trojan Mine completed deepening of its subvertical shaft and the partial modernization of its concentrator. The Bindura smelter and refinery increased production of nickel by 2% to12,889 t compared with that of 2000. About 42% of nickel production was from toll material, chiefly from Botswana. Bindura also produced 5,041 t of copper sulfide and 120 t of cobalt in cake. Combined measured and indicated and inferred resources at BNC were estimated to be 32.3 Mt at a grade of 0.64% nickel, of which 2.43 Mt at grade of 0.63% nickel was classified as proved and probable ore reserves (Bindura Nickel Corp. Ltd., 2002). Rio Tinto operated the Empress nickel refinery, which processed matte supplied from Botswana on a toll basis. The company toll refined 6,635 t nickel in 2001.

Platinum-Group Metals.—Platinum-group metals (PGM) production in 2001 increased to 5% from 1% compared with that of

Digitized by Google

2000 to 371 kg of platinum, 519 kg of palladium, and 42 kg of rhodium as Zimbabwe Platinum Mines Limited (Zimplats) commissioned its new Makwiro project near Ngezi at yearend 2001. Zimplats was a partnership between Delta Gold NL of Australia (51%) and Impala Platinum Limited of South Africa (Implats). In March 2001, Implats acquired for $30 million a 40% stake in the Ngezi-Hartley PGM assets of Delta Gold along the Great Dyke, which comprised the mothballed Hartley platinum mine, the Ngezi project, and the Selous Metallurgical Complex (SMC). Ngezi is located some 77 kilometers from the SMC. Zimplats incorporated the Ngezi project under Makwiro Platinum Mines (Private) Ltd. The Makwiro Mine was expected to be in full production by the end of 2002 and will produce 3,350 kilograms per year (kg/yr) of platinum, 2,550 kg/yr of palladium, 250 kg/yr of rhodium, 370 kg/yr of gold, and minor byproduct nickel and copper (Impala Platinum Holdings Ltd., 2002§).

ZCE Platinum (Pty) Ltd. (a partnership between Aquarius Platinum Ltd. of Australia and Implats, which acquired a 35% stake in 2001 for $30 million) operated the Mimosa Mine at the southern end of the Great Dyke. ZCE Platinum planned to increase its production at the Mimosa Mine to 2,115 kg/yr of platinum by 2003 from 466 kg/yr. Concentrates will be sent to Impala Refining Services in South Africa for treatment. The Implats expansion into Zimbabwe was part of its overall goal to increase corporate platinum production to 62,200 kg (2 million ounces) by 2006 (Impala Platinum Holdings Ltd., 2001§, 2002§).

Industrial Minerals

Asbestos.—African Associated Mines (Pvt) Ltd. produced chrysotile asbestos from its Gaths and Shabanie Mines and employed about 6,000 people. Production in 2001 was 136,000 t of asbestos valued at $49 million.

Lithium.—Bikita Minerals (Pvt) Ltd., which was owned by AMZIM Minerals Ltd, was one of the world's largest producers of lithium-bearing petalite. Between 1999 and 2001, production ranged from 36,000 to 38,000 t/yr of lithium minerals. The company exported four grades of petalite, which included grades for container glass and tile, lithium, and spodumene concentrates.

Mineral Fuels

Wankie operated the country's only coal mine near Hwange. In 2001, production increased by 7% to 4.06 Mt. In 2001, the company suffered major loss financial losses, in inflation-adjusted terms, and was saddled with a nearly $33 million debt, based on the official exchange rate, from one of its two main customers, Ziscosteel. During 2001, Wankie saw an increase in coal sales to 1,432,619 t from 1,429,123 t. Sales of power station coal also increased to 2,318,799 t from 1,885,137 t. Coke sales dropped to 245,822 t from 411,409 t. Coke oven gas dropped to 27.1 million cubic meters from 29.5 million cubic meters (Insider [Harare], 2002§).

Zimbabwe has no domestic reserves of oil or gas and depended on coal, hydropower, and imports to meet its energy requirements. Like many African countries, firewood and charcoal were major sources of fuel, particularly for household cooking. The country no longer had a functioning oil refinery and has spent around $55 million per year to import petroleum products from South Africa. Fuel shortages that resulted from the economic crisis in the country remained a major problem during the year (MBendi Information Services, 2000§).

Infrastructure

Most of landlocked Zimbabwe's bulk commodities were moved by rail on the state-owned National Railways of Zimbabwe (NRZ). All major cities and industrial centers were linked to Botswana, Mozambique, South Africa, and Zambia by the NRZ. Petroleum products were piped through Mozambique via the Beira pipeline to Feruka and then moved west via the Mutare-Harare pipeline or trucked on Zimbabwe's 85,784-km road network. Additional petroleum products were imported via railroad tanker cars through South Africa.

Outlook

The short-term outlook for the mining sector was not favorable. Government intervention in the economy and in state-run industries has been a major contributor to the growing number of closed mines and suspended projects that are undermining the ability of the mining sectors to continue to generate more than 25% of Zimbabwe's foreign export earnings. External market forces and weak commodity prices have also had a serious impact on ferroalloys, gold, and steel. The natural resource endowment and a well-developed infrastructure remain in place. Until the Government can complete the privatization of its interests in the energy, mining, and rail sectors; repay the debts of the parastatal industries; and loosen its foreign exchange rules, attracting the open competition and entrepreneurship needed to stimulate the economy will be difficult.

References Cited

Bindura Nickel Corp. Ltd., 2002, Bindura Nickel Corp. Ltd. annual report for 2001: Harare, Zimbabwe, Bindura Nickel Corp. Ltd., March 8, 42 p.

Holloway, John, and associates, 2002, Zimbabwe, *in* Mining annual review 2002: London, Unitd Kingdom, Mining Journal Ltd. CD-ROM.

Internet References Cited

Ashanti Goldfields Co. Ltd., 2002 (March), Annual report for 2001, accessed October, 1, 2002, at URL http://www.investorrelations.co.uk/ashantigold/reports/Ashanti_RA.pdf.

Cluff Mining plc, 2002 (April 17), Operating review, Annual Report for 2001, accessed November 29, 2001, via URL http://www.cluff-mining.com.

Financial Gazette [Zimbabwe], 2001 (October 2), Zimbabwe to be hit by steel shortages, accessed November 29, 2002, at URL http://www.africaonline.com/site/Articles/1,3,41306.jsp.

Impala Platinum Holdings Ltd., 2001, Annual report for the financial year ending June 30, 2001, accessed November 30, 2002, at URL http://www.implats.co.za/annual_report/2001/PNG/template.htm.

Impala Platinum Holdings Ltd., 2002, Interim results for the six months ended 31 December 2001, accessed November 30, 2002, at URL http://www.implats.co.za/annual_report/2002/Implatsenglish.PDF.

Insider [Harare], 2002 (May 24), Wankie has mediocre performance, accessed November 28, 2002, at URL http://allafrica.com/stories/200205240686.html.

Digitized by Google

International Monetary Fund, 2001 (September 25), IMF declares Zimbabwe ineligible to use IMF resources, Press Release, accessed October 14, 2002, at http://www.imf.org/external/np/sec/pr/2001/pr0140.htm.
International Monetary Fund, 2002 (June), Zimbabwe—Recent economic developments—Statistical appendix, IMF Country Report No. 02/126, accessed October 10, 2002, at URL http://www.imf.org/external/pubs/ft/scr/2002/cr02126.pdf.
Joint United Nations Programme on HIV/AIDS, 2002 (June), Zimbabwe, Epidemiological Fact Sheet, accessed October 12, 2002, at URL http://www.unaids.org/hivaidsinfo/statistics/fact_sheets/pdfs/zimbabwe.en.pdf.
Kinross Gold Corp., 2002, Management discussion and analysis, Annual Report for 2001, accessed November 10, 2002, at URL http://www.kinross.com/finan/index.html.
Lonmin plc, 2001, Annual review for the year ended September 30, 2001, accessed November 10, 2002, via URL http://www.lonmin.com.
MBendi Information Services, 2000 (September 27), Zimbabwe—Oil and gas industry, accessed November 28, 2002, at URL http://www.mbendi.co.za/indy/oilg/af/zi/p0005.htm.
U.S. State Department, 2000 (July), Zimbabwe, Country Commercial Guide 2001, accessed June 15, 2001, at URL http://www.state.gov/www/about_state/business/com_guides/2001/africa/zimbabwe_ccg2001.pdf.
World Bank, 2001 (October 3), World Bank places Zimbabwe on non-payment status, Press Release, accessed October 10, 2002, at URL http://lnweb18.worldbank.org/news/pressrelease.nsf/92203140240d75178525678c00585fc3/f56323150261fb048525696d0072d584?OpenDocument.

Major Sources of Information

Ministry of Mines, Environment, and Tourism
Private Bag 7753, Causeway
Harare, Zimbabwe

Chamber of Mines
4 Central Ave., Stewart House
P.O. Box 712
Harare, Zimbabwe
Telephone: (263) (4) 702-841
Fax: (263) (4) 707-983
Website: http://www.chamines.co.zw/
E-mail: chamines@utande.co.zw

Zimbabwe Geological Survey
Mafue Bldg., 5th and Selous
P.O. Box CY210, Causeway
Harare, Zimbabwe
Telephone: (263) (4) 726-342 or 252016
Fax: (263) (4) 739-601
E-mail: zimgeosv@africaonline.co.zw

Major Publications

Bartholomew, D.S., 1990a, Base metal and industrial mineral deposits of Zimbabwe. Zimbabwe Geological Survey Mineral Resources Series No. 22, Harare, 154 p.
Bartholomew, D.S., 1990b, Gold deposits of Zimbabwe. Zimbabwe Geological Survey Mineral Resources Series No. 23, Harare, 75 p.
The Chamber of Mines Journal, Harare, monthly.
Mining in Zimbabwe, Thomson Publications, Harare, annual.

Digitized by Google

TABLE 1
ZIMBABWE: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000	2001
METALS						
Chromite, gross weight	thousand tons	640	636	641 r/	668 3/	780
Cobalt, metal 4/		126	138	121 3/	79 3/	95
Copper:						
Mine output, concentrate, Cu content		4,993	2,941	4,511	2,104	2,057
Metal:						
Smelter output, blister/anode, primary e/		18,000	14,500 r/	14,500 r/	14,500	2,160 e/
Refinery output, refined/cathode, primary		13,000	11,000	10,000	10,200 r/	2,057
Gold	kilograms	24,156	25,175	27,666 3/	22,069 3/	18,050 3/
Iron and steel:						
Mine output, iron ore:						
Gross weight	thousand tons	479	372	599	451 3/	361
Fe content e/	do.	240	190	300	225 3/	180
Metal:						
Pig iron e/	do.	216	230	230	240	240
Steel, crude	do.	214	220	255 r/	258 r/3/	156
Ferroalloys:						
Ferrochromium	do.	235	241	248	246 3/	250
Ferrosilicon chromium	do.	17	21	16 r/	20	17
Nickel:						
Mine output, concentrate, Ni content		12,963	12,872	11,164	8,160 e/	10,120
Refinery output, refined metal						
Refined from domestic materials		10,300 5/	8,732	9,106 r/	6,678 3/	7,440
Toll refined from imported materials		7,346 5/	8,709	10,676 r/	12,931 3/	12,084
Total refined nickel metal		17,646	17,441	19,782	19,609	19,524
Platinum-group metals:						
Palladium	kilograms	245	1,855	342	366 3/	371
Platinum	do.	345	2,730	479	505 3/	519
Rhodium	do.	27	177	37 r/	40	42
Silver	do.	5,923	6,681	5,181 r/	3,799 3/	3,449
Tantalum, mine output, Ta content e/		1	6	1	1	7
INDUSTRIAL MINERALS						
Asbestos	thousand tons	145	123	115	152 3/	136
Barite		1,217	1,844	1,000 e/	5,032	7,464
Cement, hydraulic e/	thousand tons	1,100	1,100	1,000	1,000	1,000
Clays:						
Bentonite (montmorillonite)		121,283	135,785	140,000 e/	--	--
Other clays 6/		24,000	12,000	12,000	589	2,247
Diamond	carats	421,307	28,732	45,324	16,678 3/	15,000
Feldspar		2,254	2,241	2,250	2,059	1,055
Gemstones: e/						
Amethyst	kilograms	NA	NA	NA	10,376	840
Emerald	do.	1,000 e/	19,302	20,000 r/	33	57
Graphite		12,779	13,806	11,405 r/	11,838 3/	11,836
Kyanite		1,113	3,780	4,000 e/	10,970	9,682
Lithium minerals, gross weight		49,833	28,055	36,671	37,914 3/	36,103
Magnesite		13,050	4,321	5,356 r/	4,029	2,439
Mica		30	1,309	1,300 e/	--	--
Nitrogen, N content of ammonia		63,700	56,500	60,800 3/	58,400 3/	57,500
Perlite		--	--	5,356	5,000	5,000
Phosphate rock, marketable concentrate		94,000	91,000	126,000	77,662	86,611
Stone, sand and gravel:						
Granite		109,903	125,576	130,000 e/	130,000	385,532
Limestone	thousand tons	1,027	1,473	1,500 e/	1,500	3,799
Quartz 7/	do.	52	40 r/e/	40 r/e/	121 r/e/	28
Sulfur						
Pyrite:						
Gross weight		48,101	52,908	48,793	69,119	98,037
S content (32.6%)		15,700	15,250	15,900	22,530	31,960
Byproduct acid, metallurgical and coal process gas e/		5,000	2,500	2,500	2,500	2,000
Talc		1,023	1,039	1,000 e/	989	1,273
Vermiculite		14,841	14,804	13,898	16,215	11,632

See footnotes at end of table.

Digitized by Google

TABLE 1--Continued
ZIMBABWE: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000	2001
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous	thousand tons	5,301	5,047	4,576	3,809 3/	4,064
Coke, metallurgical e/	do.	600	600	600	600	245

e/ Estimated. r/ Revised. -- Zero. NA Not available.

1/ Table includes data available through August 2002.

2/ Estimated data are rounded to no more than three significant digits; may not add to totals shown.

3/ Reported figure.

4/ "Metal" includes metal content of compounds/salts and may include cobalt recovered from nickel-copper matte imported for toll refining.

5/ Toll refined data include all Empress Refinery production from Botswana imports and part of Bindura output.

6/ Includes fire clay.

7/ Includes rough and ground quartz as well as silica sand.

Sources: U.S. Geological Survey Minerals Questionnaire prepared by Zimbabwe Ministry of Mines and Energy; Zimbabwe Chamber of Mines

Digitized by Google

THE MINERAL INDUSTRIES OF

THE MIDDLE EAST

By Philip M. Mobbs, David R. Wilburn, and Thomas R. Yager

The 15 nations of the Middle East that are covered in this volume encompass an area of more than 6 million square kilometers, which is about two-thirds the size of the United States. In 2001, the total population of the Middle East region was estimated to be about 241 million compared with 278 million for the United States and 6.16 billion for the world. The Middle East has significant reserves of boron minerals, crude oil, natural gas, and phosphate rock. In general, the larger countries of the region (Iran, Oman, Saudi Arabia, Turkey, and Yemen) had significantly more diverse mineral resources than the smaller countries. Iraq was relatively unexplored compared with the other countries in the region.

Acknowledgments

The U.S. Geological Survey thanks the following Government agencies for providing minerals production statistics:

- Kingdom of Bahrain—Office of the Assistant Undersecretary for Oil Affairs of the Ministry of Oil;
- Cyprus—Mines Service of the Ministry of Agriculture, Natural Resource, and Environment;
- Arab Republic of Egypt—Central Agency for Public Mobilization and Statistics;
- Sultanate of Oman—Ministry of Commerce and Industry;
- Qatar—Ministry of Energy & Industry and Qatar Petroleum; and
- Turkey—Türkiye Petrolleri A.O.

General Economic Conditions

The economies of most of the region revolved around trade and the exportation of raw and processed mineral commodities, especially the production and processing of crude petroleum and natural gas (table 1). Energy production that used locally produced petroleum and natural gas was an important component of the industrialization of the region. In 2001, according to the International Monetary Fund (2002§[1]), the annual change in the gross domestic product (GDP) of the Middle Eastern nations (except Iraq) covered in this section grew at an average of 2.7% compared with 5.2% in 2000 (table 2). The decline was attributed to the slowdown of the global economy (World Bank, 2002§).

Investment Data and Political Risk

State-owned companies dominated the region's mineral industry. In 2001, processing facilities dominated the list of proposed mineral industry projects; the cyclical downturn in international oil prices in 2001 and associated reduced governmental income, however, could result in the postponement of a number of the proposed projects. Proposed investment in the region related to the mineral industry includes new crude oil refineries or expansion of existing refinery capacity in Iran, Iraq, Kuwait, Lebanon, Oman, and Turkey. Natural gas pipelines, gas processing plants, or gas-to-liquid facilities were proposed for Cyprus, Iran, Kuwait, Qatar, Turkey, and the United Arab Emirates (UAE). A petroleum coke plant was planned for the UAE. New ammonia, methanol, or urea plants or plant expansions were proposed for Iran, Kuwait, Oman, Qatar, and the UAE. An alumina refinery was under construction in Iran. Aluminum extrusion facilities were proposed for Qatar, and an aluminum rolling mill was proposed for the UAE. New aluminum smelters or existing smelter capacity expansions were proposed for Bahrain, Oman, Turkey, and the UAE. New iron and steel processing facilities were proposed for Iran, Kuwait, and the UAE. Boric acid, sulfuric acid, and synthetic zeolite plants were proposed for Turkey. A cement factory expansion was planned in Yemen. New bromine facilities were proposed in Jordan. A new gold mine was under construction in Saudi Arabia.

Exploration

Reported industrial mineral and metal exploration activity was concentrated in Iran and Turkey. Exploration and evaluation operations included prospecting for base and precious metals in Cyprus, Iran, Oman, Saudi Arabia, Syria, Turkey, and Yemen (table 2). Hydrocarbon exploration continued in Bahrain, Iran, Iraq, Israel, Jordan, Oman, Qatar, Saudi Arabia, Syria, Turkey, the UAE, and Yemen. Cyprus continued discussions with Egypt concerning exploration of the possible extension of Egyptian natural gas reservoirs into the Cypriot exclusive economic zone and the allocation of any recovered natural gas (table 3).

[1]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

Commodity Review

Historical production of aluminum metal (primary), bauxite, coal (which included anthracite and bituminous), copper ore and metal, gold ore, iron ore, lead ore, lignite, lead metal (primary and secondary), natural gas, petroleum (crude), phosphate rock, silver ore, steel (crude), and zinc ore and metal were compiled as tables 4 to 20. To conform with the list of commodities covered in the Africa, Asia and the Pacific, Europe and Central Eurasia, and Latin America and Canada introduction chapters, no production of secondary aluminum metal, diamond, nickel ore, platinum-group-metal ore, tin ore and metal, and tungsten ore was reported in the Middle East.

The outlook segments of the mineral commodity tables are based on projected trends that could affect current (2001) producing facilities and on planned new facilities that operating companies, consortia, or Governments have projected to come online within indicated timeframes. Projects that have received approval from the company's board of directors would be typical of projects that could develop within the indicated timeframes. Forward-looking information, which includes estimates of future production, exploration and mine development, cost of capital projects, and timing of operations onset are subject to a variety of risks and uncertainties that could cause actual events or results to differ significantly from expected results. Projects listed in the following section are presented as an indication of current (2001) industry plans and are not a USGS prediction of what will happen. The USGS provides no warranty, expressed or implied, as to the accuracy, reliability, or completeness of furnished data and is under no obligation to correct or update any forward-looking statements, whether as a result of new information or as future events take place.

Metals

Increased bauxite production is expected in Iran when the Jajarm alumina plant begins commercial operations. Regional aluminum output is envisioned to increase, augmented in Bahrain with the completion of Aluminium Bahrain's fifth potline, in Iran with the completion of the Bandar Abbas smelter, in Turkey with the expansion of the Seydehiser plant, and in the UAE with the expansion of Dubai Aluminium Company's Jebel Ali's smelter. Mined copper ore in the region was projected to increase when additional output from the Meiduk and the Songon Mines in Iran comes online and when block 1 is developed in Oman. Increased gold production in the region is anticipated with the proposed development of new mines in Iran, Saudi Arabia, and Turkey and the expansion of older mines in Iran and Oman.

Continued expansion of steel plant capacity in Iran is expected to result in a significant growth of crude steel output. The development of the Al-Jabail zinc mine in Yemen and an associated zinc refinery in Saudi Arabia was expected to augment Middle Eastern lead and zinc production.

Industrial Minerals

A significant increase in phosphate rock production capacity was planned for the Shiyada Mine in Jordan.

Mineral Fuels

New foreign direct investment in the Iranian coal industry was expected to result in increased output. With the increased international interest in the development of natural gas resources and markets, the successful offshore natural gas exploration efforts in the Mediterranean Sea and the Persian Gulf, and proposed development of onshore gas resources in Saudi Arabia, natural gas production in the Middle East is expected to increase by about 50% by 2007.

Trade

By September 28, 2001, the international insurance industry had declared much of the region to be exclusion zones from basic war risks insurance. The affected areas included sections of the Arabian Sea, the Gulf of Aden, the Gulf of Aqaba, the Gulf of Oman, the southeastern Mediterranean Sea, the Persian Gulf, and the Red Sea. For ship owners, the base hull war risk premium was increased, and additional insurance premiums were charged for operating in exclusion zones. To cope with the increases, shipping lines imposed a war risk surcharge on ocean shipments in the region.

The region was a major supplier of crude oil and natural gas to Asia and crude oil to the United States. The Middle East region supplied about 29% of the 3.4 billion barrels of crude oil that the United States imported in 2001. Saudi Arabia, which was the leading supplier of crude oil to the United States, provided 588 million barrels (Mbbl), or 17% of the United States' crude oil imports. Iraq, with exports of 290 Mbbl to the United States, was in sixth place on the list of the largest crude oil suppliers to the United States. Kuwait, which was the source of nearly 87 Mbbl crude oil, remained 11th on the list (U.S. Energy Information Administration, 2002).

Reference Cited

U.S. Energy Information Administration, 2002, Table S3—Crude oil and petroleum product imports—1986-present: Petroleum Supply Monthly, December, p. 8-15.

Internet References Cited

International Monetary Fund, 2002, Real gross domestic product (annual percent change)—All countries, accessed October 3, 2002, at URL http://www.imf.org/external/pubs/ft/weo/2002/02/data/growth_a.csv.

World Bank, 2002, Figure 1.1—World and industrial and developing country GDP growth, 1987-2004, Global Development Finance 2002, accessed July 26, 2003, at URL http://www.worldbank.org/prospects/gdf2002/vol1-pdf/pdfcharts/ch1charts.pdf.

Digitized by Google

TABLE 1
MIDDLE EAST: PRODUCTION OF SELECTED MINERAL COMMODITIES IN 2001 1/ 2/

(Thousand metric tons unless otherwise specified)

Country	Aluminum e/	Boron	Cement, hydraulic e/	Chromite (gross weight)	Gypsum e/	Natural gas: Dry (million cubic meters)	Natural gas: Plant liquids (thousand 42-gallon barrels)
Bahrain	510	--	89 3/	--	--	9,285	3,624
Cyprus	--	--	1,369 3/	--	250	--	--
Iran	140	4	24,000	105	11,000	65,000	25,000
Iraq	--	--	2,000	--	--	2,920	4,000
Israel	--	--	6,900	--	133	10	--
Jordan	--	--	3,159 3/	--	163	290	--
Kuwait	--	--	1,600	--	--	9,500	44,300
Lebanon	--	--	2,700	--	2	--	--
Oman	--	--	1,370	30	30 3/	13,400	6,000
Qatar	--	--	1,050	--	--	27,738	26,726
Saudi Arabia	--	--	20,600	--	450	54,900	292,385
Syria	--	--	4,840	--	345	3,900 e/	4,010 e/
Turkey	61	1,500	35,000	390	300	600	--
United Arab Emirates	500	--	6,100	10 e/	90	41,300	80,000
Yemen	--	--	1,400	--	100	--	2,400
Total Middle East 4/	1,210	1,500	112,000	535	12,900	229,000	488,000
World, total e/	24,400	4,620	1,700,000	12,100	104,000	2,460,000	2,330,000 e/
Share of world total, percentage	5	32	7	4	12	9	21
United States	2,637 3/	1,050	90,450 3/ 5/	--	16,300	555,000	682,000

Country	Nitrogen, N in ammonia	Petroleum, crude (thousand 42-gallon barrels) 6/	Phosphate rock (P_2O_5 content)	Potash K_2O equivalent	Salt e/	Steel, crude e/	Sulfur e/
Bahrain	372	13,656	--	--	--	--	68 3/
Cyprus	--	--	--	--	--	--	--
Iran	1,087	1,350,000	--	--	2,000	6,890	1,350
Iraq	220 e/	860,000	100 e/	--	300	50	100
Israel	--	25 e/	1,115 3/	1,774 3/	537	220	39
Jordan	--	--	1,928 3/	1,180 e/	321	30	--
Kuwait	420	745,000	--	--	100	--	524
Lebanon	--	--	--	--	4	--	--
Oman	--	352,000 e/	--	--	--	--	30
Qatar	1,159	237,000	--	--	--	908 3/	221 3/
Saudi Arabia	1,774	2,763,000	--	--	200	3,400	2,350
Syria	138	194	613 3/	--	106	70	17
Turkey	50 e/	18,370	--	--	2,100	14,981	156
United Arab Emirates	350 e/	790,000 e/	--	--	--	70	1,400
Yemen	--	165,000 e/	--	--	150	--	--
Total Middle East 4/	5,570 e/	7,290,000	3,760	2,950	5,820	26,600	6,260
World, total e/	106,000	24,900,000	41,400	26,000	225,000	851,000	57,300
Share of world total, percentage	5	29	9	11	3	3	11
United States	9,730 7/	2,120,000	9,230 3/	1,200	44,800 9/	90,084 3/	9,250 3/

e/ Estimated. -- Negligible or no production.

1/ Table includes data available through February 26, 2003.

2/ Data may be different from that which appear in individual country production tables owing to availability of more current data.

3/ Reported figure.

4/ May not add to totals shown because of independent rounding.

5/ Includes Puerto Rico.

6/ Includes lease condensate.

7/ Synthetic anhydrous ammonia; excludes coke oven byproduct ammonia.

Digitized by Google

TABLE 2
MIDDLE EAST: 2001 GROSS DOMESTIC PRODUCT AT PURCHASING POWER PARITY, POPULATION, AND AREAL EXTENT

Country	Gross domestic product (GDP) at purchasing power parity 1/ (billions)	Estimated population 2/ (millions)	Area 3/ (square kilometers)
Bahrain	$8.4	$0.6	665
Cyprus	10.2	0.8	9,250
Iran	426.0	66.1	1,648,000
Iraq	59.0	23.3	437,072
Israel	121.9	9.1	26,990
Jordan	21.6	5.2	92,300
Kuwait	30.9	2.0	17,820
Lebanon	18.8	3.6	10,400
Oman	21.5	2.6	212,460
Qatar	16.3	0.8	11,437
Saudi Arabia	241.0	22.8	1,960,582
Syria	54.2	16.7	185,180
Turkey	443.0	66.5	780,580
United Arab Emirates	51.0	2.4	82,880
Yemen	14.8	18.1	527,970
Total	1,539	241	6,003,586
United States	10,082	278	9,269,091
World	47,000	6,157	510,072,000

1/ Source: U.S. Central Intelligence Agency, World Factbook 2002, accessed February 4, 2003, at URL http://www.cia.gov/cia/publications/factbook/fields/2001.html. For information on the difference between nominal, purchasing power parity, and real GDP, please refer to URL http://www.cia.gov/cia/publications/factbook/docs/notesandrefs.html#2001.

2/ Sources: U.S. Central Intelligence Agency, World Factbook 2001, accessed February 4, 2003, at URL http://www.bartleby.com/151/20.html, http://www.bartleby.com/151/65.html, http://www.bartleby.com/151/89.html, http://www.bartleby.com/151/116.html, http://www.bartleby.com/151/117.html, http://www.bartleby.com/151/119.html, http://www.bartleby.com/151/127.html, http://www.bartleby.com/151/135.html, http://www.bartleby.com/151/139.html, http://www.bartleby.com/151/184.html, http://www.bartleby.com/151/199.html, http://www.bartleby.com/151/212.html, http://www.bartleby.com/151/233.html, http://www.bartleby.com/151/244.html, http://www.bartleby.com/151/250.html, http://www.bartleby.com/151/252.htm, http://www.bartleby.com/151/261.html, http://www.bartleby.com/151/263.html, and http://www.bartleby.com/151/264.html.

3/ Source: U.S. Central Intelligence Agency, World Factbook 2002, accessed February 4, 2003, at URL http://www.odci.gov/cia/publications/factbook/fields/2147.html

Digitized by Google

TABLE 3
SELECTED MIDDLE EAST EXPLORATION ACTIVITY IN 2001 1/

Country	Prospect	Commodity	Companies	Resource notes 2/	Exploration notes
Cyprus	Shia-Mathiatis	Cu, Zn, Au	Eastern Mediterranean Minerals (Cyprus) Ltd.	Data not available	Preliminary drilling and reprocessed historical data.
Iran	Agh Darreh	Au	Pouya Zarcan Agh Darreh Co.	3.46 Mt at a grade of 3.9 g/t Au	Continued exploration program.
Do.	Kuh-e-Lar	Cu, Mo, Au	National Iranian Copper Industries Co. and Zarcan Minerals Inc.	Data not available	Do.
Do.	Mediabad	Zn, Pb, Ag	Iran Mines and Mineral Industry Development and Renovation Organization, Itok GmbH, and Union Capital Ltd.	217.9 Mt at a grade of 7.2% Zn, 2.34% Pb, and 51 g/t Ag	Prefeasibility study completed.
Oman	Block 1	Cu, Au	National Mining Co.	3 Mt at a grade of 2% Cu	Continued exploration program.
Turkey	Çöpler (also known as Çükürdere)	Cu, Au	Anatolia Minerals Development Ltd. and Rio Tinto Mining & Exploration Ltd.	Data not available	Mapping, sampling, and drilling.
Do.	Kabatas	Cu, Au	do.	do.	Five drill holes were cored.
Do.	Karagöz	Au	do.	do.	Soil geochemistry survey, some drilling.
Do.	Kisladag	Au	Tuprag Metal Madencilik San. Ve Tic. Ltd. Sti.	126 Mt at a grade of 1.2 g/t Au	Prefeasibility study completed. Drilling continued.
Do.	Lucky Star/ Zavikoy	Zn, Pb, Ag	Odyssey Resources Ltd.	Data not available	Magnetic, electromagnetic, ground geophysical, and stream sediment geochemical surveys completed. Resumed diamond drilling.
Do.	Tunceli	Cu, Au	Anatolia Minerals Development Ltd. and Rio Tinto Mining & Exploration Ltd.	do.	Aeromagnetic, geochemical, and surface geophysical surveys.
Yemen	Al Jabali	Zn, Pb, Ag	Anglo American plc, Ansan Wikfs Hadramaut Ltd., and ZincOx Resources plc	9.4 Mt at a grade of 10.8% Zn, 2.3% Pb, and 76.8 g/t Ag	Feasibility study under way.

1/ Abbreviations used in this table include the following: Ag--silver, Au--gold, Cu--copper, Mo--molybdenum, Pb--lead, and Zn--zinc. Abbreviations used for units of measument include the following: g/t--grams per metric ton and Mt--million metric tons.
2/ Resources reported where available based on data from various public sources. Data were not verified by the U.S. Geological Survey. Resources may include measured, indicated, and inferred resources.

TABLE 4
MIDDLE EAST: HISTORIC AND PROJECTED BAUXITE MINE PRODUCTION, 1990-2007 1/

(Metric tons)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Iran	100,000 e/	148,000	400,000 e/	400,000 e/	400,000	400,000	500,000	550,000
Turkey	773,000	232,278	458,537	242,000	300,000	400,000	400,000	300,000
Total	873,000	380,000	859,000	642,000	700,000	800,000	900,000	850,000

e/ Estimated.
1/ Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 5
MIDDLE EAST: HISTORIC AND PROJECTED PRIMARY ALUMINUM METAL PRODUCTION, 1990-2007 1/

(Metric tons)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Bahrain	213,000	450,709	509,038	510,000	517,000	517,000	520,000	750,000
Iran	60,000	119,400	140,000	140,000	130,000	150,000	150,000	200,000
Turkey	61,000	61,514	61,000	61,000	62,000	62,000	110,000	110,000
United Arab Emirates	174,000	247,400	470,000	500,000	536,000	540,000	600,000	700,000
Total	508,000	879,000	1,180,000	1,210,000	1,240,000	1,270,000	1,380,000	1,760,000

e/ Estimated.
1/ Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

Digitized by Google

TABLE 6
MIDDLE EAST: HISTORIC AND PROJECTED ANTHRACITE AND BITUMINOUS COAL PRODUCTION, 1990-2007 1/

(Thousand metric tons)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Iran	1,440	1,640	1,815	2,000	2,000	2,000	2,500	2,500
Turkey	5,630	3,377	3,330	3,300	3,300	3,000	3,000	2,000
Total	7,070	5,020	5,150	5,300	5,300	5,000	5,500	4,500

e/ Estimated.
1/ Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 7
MIDDLE EAST: HISTORIC AND PROJECTED LIGNITE PRODUCTION, 1990-2007 1/

(Thousand metric tons)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Turkey	46,900	56,031	61,315	60,000	60,000	60,000	65,000	65,000
Total	46,900	56,000	61,300	60,000	60,000	60,000	65,000	65,000

e/ Estimated.
1/ Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 8
MIDDLE EAST: HISTORIC AND PROJECTED COPPER MINE PRODUCTION, 1990-2007 1/ 2/

(Thousand metric tons of metal content of ore)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Cyprus	--	--	11	8	8	8	8	8
Iran	79	120 e/	138 e/	144	145	145	160	160
Oman	14	--	--	--	--	--	2	10
Saudi Arabia	1	1	1	1	1	1	1	--
Turkey	40	40	76	52	64	60	60	55
Total	134	161	226	205	218	214	230	230

e/ Estimated. -- Negligible or no production.
1/ Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
2/ Copper content of mined ore (gross weight).

TABLE 9
MIDDLE EAST: HISTORIC AND PROJECTED REFINED COPPER METAL PRODUCTION, 1990-2007 1/ 2/

(Metric tons)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Cyprus 3/	--	--	5,197	5,176	5,000	5,200	5,200	5,100
Iran	47,800	90,400	132,000	132,000	130,000	135,000	200,000	240,000
Oman	12,000	33,900	24,281	24,000	23,000	25,000	25,000	30,000
Turkey	84,200	100,300	78,000	78,000	75,000	80,000	80,000	80,000
Total	144,000	225,000	240,000	239,000	233,000	245,000	260,000	265,000

e/ Estimated. -- Negligible or no production.
1/ Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
2/ May include secondary production.
3/ Production from Cyprus is electrowon.

Digitized by Google

TABLE 10
MIDDLE EAST: HISTORIC AND PROJECTED GOLD MINE PRODUCTION, 1990-2007 1/

(Kilograms of metal content of ore)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Iran	500	630	765	770	(2/)	(2/)	(2/)	(2/)
Oman	54	591	597	604	(2/)	(2/)	(2/)	(2/)
Saudi Arabia	3,540	8,080	3,800	5,000	(2/)	(2/)	(2/)	(2/)
Turkey	1,010	1,200	500	500	(2/)	(2/)	(2/)	(2/)
Other	XX	XX	XX	XX	7,500	7,500	9,000	14,000
Total	5,100	10,500	6,100	7,270	7,500	7,500	9,000	14,000

e/ Estimated. XX Not applicable.
1/ Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
2/ Included in "Other."

TABLE 11
MIDDLE EAST: ESTIMATED HISTORIC AND PROJECTED IRON ORE MINE PRODUCTION, 1990-2007 1/

(Thousand metric tons of metal content of ore)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Iran	1,800	4,500	5,500	5,900	6,000	6,000	6,200	6,200
Turkey	2,690 2/	2,750	2,450	2,400	2,400	2,500	2,500	2,500
Total	4,490	7,250	7,950	8,300	8,400	8,500	8,700	8,700

e/ Estimated.
1/ Estimated data are rounded to no more than three significant digits.
2/ Reported.

TABLE 12
MIDDLE EAST: HISTORIC AND PROJECTED STEEL PRODUCTION, 1990-2007 1/

(Thousand metric tons)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Iran	1,425	4,696	6,600	6,890	7,321 2/	7,500	10,000	14,500
Iraq e/	150	300	50	50	50	50	200	200
Israel e/	144	200	270	220	150	150	150	150
Jordan e/	179 2/	30	30	30	30	30	30	30
Qatar	580	614 e/	744	910	1,027 2/	1,100	1,100	1,100
Saudi Arabia	1,833	2,451	2,973	3,413	3,556 2/	3,500	3,500	3,500
Syria e/	76 2/	70	70	70	70	70	70	70
Turkey	9,322	12,744	14,325	14,981	16,472	16,500	16,500	16,500
United Arab Emirates	--	--	--	--	--	--	--	400
Total	13,700	21,100	25,100	26,600	28,700	28,900	31,500	36,500

e/ Estimated. -- Negligible or no production.
1/ Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
2/ Reported figure.

TABLE 13
MIDDLE EAST: HISTORIC AND PROJECTED LEAD MINE PRODUCTION, 1990-2007 1/

(Metric tons of metal content of ore)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Iran	11,000	15,900	15,000	15,000	15,000	15,000	15,000	15,000
Saudi Arabia	250	50	50	60	60	60	50	50
Turkey	18,000	10,376	17,270	18,000	18,000	18,000	18,000	18,000
Yemen	--	--	--	--	--	--	--	5,000
Total	29,300	26,300	32,300	33,100	33,100	33,000	33,000	38,000

e/ Estimated. -- Negligible or no production.
1/ Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

Digitized by Google

TABLE 14
MIDDLE EAST: HISTORIC AND PROJECTED PRIMARY AND SECONDARY REFINED LEAD PRODUCTION, 1990-2007 1/

(Metric tons)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Iran e/	10,000	45,200	47,000	50,000	50,000	50,000	50,000	50,000
Israel	--	8,200	13,000	20,000	22,000	25,000	25,000	25,000
Turkey e/	9,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Total	19,000	57,400	64,000	74,000	76,000	79,000	79,000	79,000

e/ Estimated. -- Negligible or no production.
1/ Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 15
MIDDLE EAST: HISTORIC AND PROJECTED NATURAL GAS PRODUCTION, 1990-2007 1/

(Million cubic meters of dry gas)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Bahrain	6,000	7,205	11,500	12,100	12,000	12,000	12,000	12,000
Iran	23,800	36,600	57,800	65,000	70,000	80,000	100,000	125,000
Iraq	4,200	3,000	3,000	2,920	3,000	3,000	3,000	3,000
Israel	40	21	10	10	10	10	1,800	1,800
Jordan	--	30	287	290	270	270	540	540
Kuwait	5,200	9,280	9,600	9,500	9,500	9,500	9,500	9,500
Oman	3,000	3,015	12,020	13,400	13,500	14,000	15,000	15,000
Qatar	6,090	13,600	26,141	27,738	30,000	30,000	35,000	60,000
Saudi Arabia	30,800	38,030	58,870	54,900	55,000	60,000	70,000	75,000
Syria	1,200	2,900	3,886	3,900	5,700	5,700	7,300	7,300
Turkey	212	182	612	600	600	600	500	500
United Arab Emirates	23,800	31,320	39,800	41,300	40,000	40,000	40,000	40,000
Yemen 2/	--	--	--	--	--	--	--	--
Total	104,000	145,000	224,000	232,000	240,000	255,000	295,000	350,000

e/ Estimated. -- Negligible or no production.
1/ Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
2/ Most natural gas produced in Yemen was stripped of liquids and reinjected.

TABLE 16
MIDDLE EAST: HISTORIC AND PROJECTED CRUDE PETROLEUM (INCLUDING CONDENSATE) PRODUCTION, 1990-2007 1/

(Thousand 42-gallon barrels)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Bahrain	15,900	14,468	13,776	13,656	13,500	13,400	13,500	13,500
Iran	1,130,000	1,329,700	1,360,000	1,350,000	1,250,000	1,300,000	1,300,000	1,400,000
Iraq	745,000	205,000	937,000	860,000	733,000	700,000	800,000	900,000
Israel	94	36	25	25	26	26	26	26
Jordan	116	20	15	15	15	15	15	15
Kuwait	428,000	752,265	766,000	745,000	690,000	690,000	700,000	700,000
Oman	250,000	311,300	340,000	352,000	330,000	350,000	350,000	350,000
Qatar	148,044	142,300	231,000	237,000	237,000	235,000	235,000	235,000
Saudi Arabia	2,350,000	3,004,300	2,847,000	2,763,000	2,750,000	2,800,000	3,000,000	3,000,000
Syria	140,000	222,650	199,843	194,000	185,000	194,000	194,000	194,000
Turkey	26,600	24,124	19,873	18,370	18,000	17,000	15,000	15,000
United Arab Emirates	773,000	800,500	815,000	790,000	725,000	725,000	750,000	750,000
Yemen	73,000	125,925	167,000	165,000	160,000	160,000	170,000	170,000
Total	6,080,000	6,930,000	7,700,000	7,490,000	7,090,000	7,170,000	7,500,000	7,700,000

e/ Estimated.
1/ Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

Digitized by Google

TABLE 17
MIDDLE EAST: HISTORIC AND PROJECTED PHOSPHATE ROCK PRODUCTION, 1990-2007 1/

(Thousand metric tons of P_2O_5 content of ore)

Country	1990 e/	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Iraq e/	270	300	200	100	100	100	200	200
Israel	1,104	1,264	1,305	1,115	1,100	1,250	1,250	1,250
Jordan	2,010	1,655	1,824	1,928	2,300	2,300	2,300	2,450
Syria	511	477	646	613	720	720	720	720
Total	3,900	3,700	3,980	3,760	4,220	4,370	4,470	4,620

e/ Estimated.
1/ Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 18
MIDDLE EAST: HISTORIC AND PROJECTED SILVER MINE PRODUCTION, 1990-2007 1/

(Kilograms of metal content of ore)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Iran e/	38,000	60,000	22,000	22,000	(2/)	(2/)	(2/)	(2/)
Oman	3,000	100 e/	4,894	3,153	(2/)	(2/)	(2/)	(2/)
Saudi Arabia	16,200	16,900 e/	9,300	15,000	(2/)	(2/)	(2/)	(2/)
Turkey e/	52,500	70,000	110,000	110,000	(2/)	(2/)	(2/)	(2/)
Other	XX	XX	XX	XX	145,000	142,000	144,000	148,000
Total	110,000	147,000	146,000	150,000	145,000	142,000	144,000	148,000

e/ Estimated. XX Not Applicable.
1/ Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
2/ Included in "Other."

TABLE 19
MIDDLE EAST: HISTORIC AND PROJECTED ZINC MINE PRODUCTION, 1990-2007 1/

(Metric tons of metal content of ore)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Iran	29,000 e/	145,100	85,000	85,000	87,000	90,000	100,000	100,000
Saudi Arabia	2,470	500 e/	3,000	3,300	3,400	3,500	--	--
Turkey	39,000	9,118	39	37	35	40	50	60
Yemen	--	--	--	--	--	--	--	60,000
Total	70,500	155,000	88,000	88,300	90,400	93,500	100,000	160,000

e/ Estimated. -- Negligible or no production.
1/ Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 20
MIDDLE EAST: HISTORIC AND PROJECTED ZINC METAL PRODUCTION, 1990-2007 1/

(Metric tons)

Country	1990	1995	2000	2001	2002 e/	2003 e/	2005 e/	2007 e/
Iran	--	--	50,000	50,000	50,000	60,000	75,000	75,000
Saudi Arabia	--	--	--	--	--	--	--	50,000
Turkey	21,100	17,050	33,179	--	--	--	--	--
Total	21,100	17,100	83,200	50,000	50,000	60,000	75,000	125,000

e/ Estimated. -- Negligible or no production.
1/ Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

Digitized by Google

Digitized by Google

THE MINERAL INDUSTRIES OF

BAHRAIN, KUWAIT, OMAN, QATAR, THE UNITED ARAB EMIRATES, AND YEMEN

By Philip M. Mobbs

Revenues associated with the production and processing of crude oil and natural gas form an integral segment of the economies of the countries of the Arabian Peninsula. Metals and industrial mineral exploration and mining were of more interest in the eastern areas of the Peninsula (Oman, United Arab Emirates, and Yemen). Mineral-processing facilities, however, have become standard features on the peninsula given the availability of low-cost energy. The increased interest in the use of natural gas as a fuel or petrochemical feedstock has focused the region on monetizing its gas production, much of which formerly had been flared or reinjected. In 2001, crude oil production quotas imposed by the Organization of the Petroleum Exporting Countries (OPEC) resulted in reduced oil and associated natural gas output for OPEC members and increased the economic attractiveness of production from nonassociated gasfields.

Numerous new mineral-based endeavors, plant expansions, and supporting infrastructure projects were proposed for the region. These included aluminum smelters; cement factories; liquefied natural gas (LNG) plants; natural gas-to-liquids facilities; regional natural gas pipelines; nitrogen fertilizer (ammonia and urea) plants; petroleum refineries; steel rolling mills, especially for concrete reinforcing bar (rebar); and units to recover sulfur from sour crude or natural gas.

BAHRAIN

Aluminum and petroleum dominated Bahrain's mineral economy. Bahraini exports of crude oil and refined petroleum products, which were valued at about $3.7 billion[1] in 2001, accounted for about 67% of Bahrain's total export earnings of $5.5 billion (Bahrain Monetary Agency, 2002). In 2001, other mineral exports were valued at almost $1.1 billion. These included aluminum and aluminum-alloy unwrought metal and semimanufactures, such as bars, foil, plates, rods, and wire ($797 million), agglomerated iron ores ($175 million), and urea ($48 million) (Kingdom of Bahrain, 2002§[2]). With a more-diversified economy than many of its Gulf region neighbors, Bahrain was viewed as having successfully weathered the downturn in international oil prices during 2001. The real gross domestic product (GDP) increased by an estimated 5% in 2001 compared with that of 2000 (Australian Department of Foreign Affairs & Trade, 2002§).

Aluminium Bahrain B.S.C. (ALBA) completed a 450,000-metric-ton-per-year (t/yr)-capacity coke-calcining plant, and the Board of Directors approved the addition of a fifth aluminum potline (Aluminium Bahrain B.S.C., 2002§). Construction of the $1.7 billion potline project was anticipated to start in late 2002 and was estimated to take 3 years. The new potline would expand ALBA's nominal capacity to 750,000 t/yr from about 500,000 t/yr (Aluminium Bahrain B.S.C., 2001a§). ALBA also began a 2-year campaign to increase amperage on potline 4 to 330 kiloamperes (kA) from 320 kA. The program to tweak potline amperage would increase the plant's aluminum production capacity by an estimated 11,000 t/yr (Aluminium Bahrain B.S.C., 2001b§).

General background information on the oil and gas sector is available in the October 2001 edition of the Bahrain Country Analysis Brief at URL http://www.eia.doe.gov/emeu/cabs/bahrain.html.

KUWAIT

Kuwait's economy revolved around the production and refining of crude oil. In 2001, the petroleum and natural gas sector contributed about 58% of the GDP and 86% of Government revenue. The GDP was estimated to have declined to $32.8 billion[3] in 2001 compared with $35.9 billion in 2000 in conjunction with the decline in international oil prices (Central Bank of Kuwait, 2002§). Kuwait was the world's 14th leading oil producer (U.S. Energy Information Administration, undated§).

In 2001, total exports were valued at $16.1 billion, of which oil exports accounted for about $15 billion and manufactured fertilizer exports accounted for $75 million. In 2000, total exports were valued at $19.5 billion, of which oil exports accounted for $18.2 billion and manufactured fertilizer exports accounted for about $64 million. Total imports in 2001 were estimated to be $7.7 billion (Central Bank of Kuwait, 2002§).

In November, United Steel Industrial Co. began test runs at its new 300,000-t/yr-capacity rebar mill. The plant was designed to produce 8- to 40-millimeter rebar. Steel for the plant will be imported from Iran, and rebar output should supplant imported rebar sourced primarily from Turkey (Metal Bulletin, 2001c).

[1]Where necessary, values have been converted from Bahraini dinars (BhD) to U.S. dollars (US$) at the rate of BhD0.377=US$1.00.

[2]References that include a section twist (§) are found in the Internet References Cited section.

[3]Where necessary, values have been converted from Kuwaiti dinars (KD) to U.S. dollars (US$) at the average exchange rate of KD0.307=US$1.00.

Digitized by Google

Kuwait Metal Collecting and Shredding Co. K.S.C. (closed) and Al Oula Iron Co. proposed to invest $3.3 million to set up an iron casting and molding plant in Kuwait. Military vehicle debris (wrecked armored personnel carriers, tanks, trucks, and other vehicles) remaining from the 1991 Gulf war was sold as scrap for about $1.5 million. Removal and export of the scrap was expected to take up to 3 years.

As part of the ongoing national privatization program, the Government's Kuwait Investment Authority announced that it would sell its 32.4% interest in Kuwait Cement Co. in September. The reaction of international financial markets to the events of September 11, however, resulted in the indefinite postponement of the divestment. At yearend, construction was completed and testing was underway at Kuwait Cement's 1.8-million-metric-ton-per-year (Mt/yr)-capacity grey cement kiln in Shuaiba (Orient Consulting Center, undated b§). Gulf Glass Manufacturing Co. K.S.C. proposed to increase its production capacity to 50,000 t/yr of glass bottles from 35,000 t/yr. About 58% of the company's output was exported (Orient Consulting Center, [undated]a§). In 2000, the Government's Petrochemical Industries Co. (PIC) sold the Salt and Chlorine Factory to Al Ahlia Investment Co. K.S.C. (closed) of Kuwait for $35.3 million.

PIC awarded an $87 million contract to build a 1,500-metric-ton-per-day (t/d)-capacity urea granulation facility at its Plant B urea establishment at Shuaiba. The granulation unit will replace the existing prill tower. Work continued on the $70 million expansion of line 1 at the Plant A urea facility to 1,750 t/d from 1,100 t/d. PIC proposed to increase the ammonia plant's line 2 capacity to 880 t/d from 800 t/d and to construct a 2,000-t/d methanol plant (Middle East Economic Digest, 2001e; t, p. 36).

In July, initial contracts were awarded for the $330 million restoration of the Mina al-Ahmadi oil refinery. Repair of the damage caused by the June 2000 explosion at the refinery was expected to take an additional year. Kuwait National Petroleum Co. K.S.C. also proposed to expand the capacity of its three refineries to between 1.2 million and 1.5 million barrels per day and to build a new 200,000- to 300,000-barrel-per-day (bbl/d) refinery. The 4-year expansion project was estimated to cost about $2.3 billion. The lower priority new refinery undertaking was projected to start up in 8 to 10 years and to cost about $800 million (Middle East Economic Digest, 2001d, q).

Kuwait Oil Co. K.S.C. proposed the construction of an 8.5-million-barrel tank farm at Mina al-Ahmadi and an associated offshore loading buoy array. Preliminary estimates indicated the 4-year project would cost around $900 million (Middle East Economic Digest, 2001a).

The Government proposed to substitute cleaner burning natural gas for the fuel oil that fired the country's power stations. Kuwaiti natural gas supply, however, was associated with crude oil production that was subject to OPEC production quotas. To ensure an adequate gas supply for the power stations and the country's growing petrochemical industry, the Government entered into negotiations to purchase natural gas from Iran and Qatar. A 23- to 40-million-cubic-meter-per-day-capacity pipeline from Qatar was estimated to cost $500 million (McDowall, 2001). The Government also was evaluating the development of the offshore Dorra gasfield in the partitioned neutral zone (PNZ).

During 2001, Arabian Oil Co. Ltd. (AOC) vigorously pursued negotiations with the Government to renew its rights in the offshore Kuwaiti portion of the PNZ. AOC had lost its concession in the Saudi Arabian section of the PNZ in 2000. AOC's existing exploration and production agreement on the Kuwaiti side of the PNZ will expire in January 2003.

OMAN

Petroleum and natural gas accounted for 74% of Government revenue. The Omani GDP rose slightly to about $20 billion[4] in 2001 compared with $19.7 billion in 2000. The average price received for Omani oil slipped to $23 per barrel from $26.71 per barrel in 2000. Oil and gas output was supplemented by the production of chromite, gold, gypsum, salt, sand and gravel, silver, and dimension stone; the smelting and refining of imported copper ore; and the manufacturing of cement.

In 2001, National Mining Co. of Oman acquired the rights to explore on block 1 near Sohar. By yearend, National Mining had identified near-surface mineralization that included about 3 million metric tons (Mt) of ore at a grade of 2% copper, and 200,000 metric tons of ore at a grade of 5 grams per metric ton (g/t) gold on the Shinas and Hatta prospects. The Japanese International Cooperation Agency continued its evaluation of deep-seated copper and gold resources in the Yangul region where the Ghuazain and Hayl As-Safil deposits were described as containing 14 Mt of low-grade copper (Madhavan, 2002§).

The Government anticipated an additional $8 billion investment in local projects that would use the country's natural gas as feedstock or fuel. Projects under negotiation or in the design phase included a natural-gas-powered aluminum smelter at Sohar proposed to come online in 2004, the construction of a 2,000-t/d ammonia plant and a 3,500-t/d urea plant at Sohar, the construction of an ammonia and granulated urea facility at Sur, a 5,000-t/d methanol plant at Sohar that was slated to begin operations in 2004, and a 75,000-bbl/d oil refinery at Sohar (Bulk Materials International, 2000; Middle East Economic Digest, 2001p; t, p. 36).

Oman Liquefied Natural Gas LLC (Oman LNG) processed about 70% of the marketed natural gas in Oman at its LNG plant at Qalhat. To ensure sufficient gas supply, the Government was attempting to reduce the flaring of natural gas and to get the gas to market. A number of gas pipeline projects, which included a 305-kilometer (km) pipeline that would connect the Fahud Field to Sohar and a 700-km line that would link the Saih Nihadya Field to Salalah (Port Raysut) were underway (Stell, 2000). National gas supply could be augmented by two gas discoveries (the Kauther and Khazzan prospects) drilled in 2001 by Petroleum Development Oman LLC (PDO). Oman LNG's anticipated challenge to acquire enough gas to fulfill its export contracts was alleviated in 2001

[4]Where necessary, values have been converted from Omani rials (OR) to U.S. dollars (US$) at the average exchange rate of OR0.381=US$1.00 for 2001 and OR0.385=US$1.00 for 2000.

Digitized by Google

when LNG deliveries to Dabhol Power Co. in India (1.6 Mt/yr scheduled to begin in November) were initially postponed owing to a dispute between the Maharashtra State Electricity Board and Enron Corp. of the United States, which had significant equity interest in Dabhol, and subsequently because of Enron's bankruptcy.

The output of PDO accounted for about 94% of the crude oil produced in Oman; the remainder was produced by international oil companies. The country's proven oil reserves were estimated to be 5.6 billion barrels and, according to the Ministry of Petroleum and Gas, natural gas reserves were estimated to range between 740 and 960 billion cubic meters (Middle East Economic Digest, 2001j; U.S. Energy Information Administration, 2001a§; Middle East Newsline, 2002§).

QATAR

Much of the Qatari economy was based on the production of crude oil, natural gas, petrochemicals, and refined petroleum products. In response to the decline in international oil prices, the Qatari GDP was estimated to have declined to $16.2 billion[5] compared with the revised figure of $16.5 billion in 2000. Oil and natural gas accounted for 56% of the GDP in 2001 compared with a revised 58% in 2000 (Qatar Central Bank, 2002§).

In 2001, the Government settled border demarcation issues with Bahrain and Saudi Arabia, and state-owned Qatar General Petroleum Corp. was renamed Qatar Petroleum (QP).

Bahrain Aluminium Extrusion Co. proposed a 7,000-t/yr aluminum extrusion plant in Qatar (Metal Bulletin, 2001b). QP contracted out the construction of a $68.5 million facility at the port of Mesaieed to handle imported crushed stone (Middle East Economic Digest, 2001b).

A number of natural-gas-related projects were underway in 2001. Qatar Fertiliser Co. Ltd. initiated the $535 million expansion of its fertilizer complex in Mesaieed, which would increase its ammonia production capacity by about 730,000 t/yr and urea output capacity by about 1.2 Mt/yr. The new capacity was expected to be onstream by 2004 (Norsk Hydro ASA, 2001).

Natural gas export projects that were to move natural gas from Qatar's North Field to Kuwait, Oman, and the United Arab Emirates showed significant progress. The Dolphin project (estimated to cost about $3.5 billion) initially included plans for the TotalFinaElf Group to produce up to 57 million cubic meters per day for Dolphin Energy Ltd. from an assigned area in the North Field and for Enron to manage a 350-km offshore pipeline from Ras Laffan, Qatar, to Taweelah, United Arab Emirates. In May, Enron sold its interest in the project to the United Arab Emirates Offsets Group. Exxon Mobil Corp. (ExxonMobil) was to manage the proposed 590-km Qatar-Kuwait offshore natural gas pipeline to Al Zour, Kuwait. Both gas pipelines were expected to be transporting gas by 2005 (Middle East Economic Digest, 2001h, r).

Qatar Liquefied Gas Co. (Qatargas) proposed a $200 million modification program for its production process. The debottlenecking was expected to raise the company's LNG capacity to 9.2 Mt/yr by 2004. In 2001, Qatargas's three LNG trains at Ras Laffan produced about 7.7 Mt/yr; the plant's design capacity was 6 Mt/yr (Middle East Economic Digest, 2001n).

In March, Ras Laffan Liquefied Natural Gas Co. II (RasGas II) was formed by QP (70% equity interest) and ExxonMobil (30%). RasGas II awarded the contract for its LNG Train 3 project, which included offshore North Field natural-gas-production facilities, pipelines, and a 4.4-Mt/yr-capacity liquefaction train at Ras Laffan. Commercial production from Train 3 was expected to be available in 2004. RasGas II also was evaluating the construction of a proposed 4.8-Mt/yr-capacity LNG train (Train 4) (Middle East Economic Digest, 2001c, k).

Four gas-to-liquids (GTL) projects were under consideration. A joint venture of QP (51% equity interest) and Sasol Synfuels International Ltd. (49%) agreed to proceed with a 24,000-bbl/d diesel fuel, 9,000-bbl/d naptha, and 1,000-bbl/d liquefied petroleum gas facility to be built in Ras Laffan. The $800 million GTL project was expected to start up in 2005 (Qatar Petroleum, 2001). QP and ExxonMobil initiated a feasibility study for an 80,000-bbl/d GTL plant proposed for Ras Laffan by 2006 (Middle East Economic Digest, 2001s). QP and Shell International Gas were evaluating a 75,000- to 110,000-bbl/d GTL plant, and Ivanhoe Energy Inc. proposed a 185,000-bbl/d GTL plant (Asia Chemical News, 2002b; Ivanhoe Energy Inc., 2002).

UNITED ARAB EMIRATES

Oil and natural gas revenues formed a significant segment of the diversified economy of the United Arab Emirates[6] (UAE). In addition to the hydrocarbon industry, the UAE had thriving finance, manufacturing, tourism, and trade industries. In 2001, a number of GDP series were reported. The Ministry of Petroleum and Mineral Resources estimated that GDP was about $64 billion[7] compared with $66 billion in 2000. The Ministry of Planning estimated that the GDP was about $68 billion in 2001 compared with $71 billion in 2000 and that crude oil accounted for 28% of GDP in 2001 compared with 34% of the GDP in 2000 (Emirates News Agency, 2002§; Shuaa Capital P.S.C., 2002§).

Abu Dhabi, which dominated the petroleum industry of the UAE, accounted for about 85% of the country's hydrocarbon production. Crude oil production from Dubai, which was used as a benchmark crude oil for daily (spot market) Middle East crude oil sales contracts, continued to decline. In November, Platts (a subsidiary of the McGraw-Hill Companies, Inc.) modified its Dubai benchmark by allowing crude oil from Oman to be substituted for Dubai crude for physical delivery and derivatives contracts.

[5]Where necessary, values have been converted from Qatari Rials to U.S. dollars at the average exchange rate of QR3.63=US$1.00 for 2001.

[6]Comprises the following: Abu Dhabi, Ajman, Dubai, Fujairah, Ras Al-Khaimah, Sharjah, and Umm al-Qaywayn.

[7]Where necessary, values have been converted from United Arab Emirate dirham (AED) to U.S. dollars (US$) at the rate of AED3.67=US$1.00 for 2000 and 2001.

Digitized by Google

Other minerals and mineral commodities produced in the UAE included aluminum and steel from Dubai; ammonia from Abu Dhabi; cement manufactured in Abu Dhabi, Ajman, Dubai, Fujairah, Ras Al-Khaimah, and Sharjah; and chromite mined in Fujairah. All mineral resources were controlled by the individual emirates and loosely administered by the Federal Government.

Dubai Aluminium Co. (Dubal) proposed a 170,000-t/yr expansion of its 536,000-t/yr plant capacity. Dubal's "Kestral" expansion project included the refurbishment of the three potlines that were commissioned in 1979 with modern reduction cells, the addition of cells to the potlines, and the renovation of the powerplant and carbon plant (Mining Journal, 2001; Dubai Aluminium Co. Ltd., 2002). Initial production from the expansion could be onstream by late 2003; the entire project should be completed by 2006. The 400,000-t/yr "Heron" expansion proposal remained under evaluation (Metal Bulletin, 2000).

A 40,000-t/yr-capacity aluminum foil rolling mill was proposed for Jebel Ali, Dubai. The $110 million plant was scheduled to be online in 2004. The proposed new foil plant will replace two previously proposed aluminum rolling mills in Dubai—the Emirates Aluminium Co. $160 million 60,000-t/yr plant and the $180 million 22,400-t/yr Aluminium Gulf Co. mill (Middle East Economic Digest, 2001i).

Dubai Cable Co. Ltd. (Ducab) was expanding its Jebel Ali copper cable factory. Operating the new plant at capacity will require about 35,000 t/yr of copper compared with recent demand of about 24,500 t/yr (Middle East Economic Digest, 2001g). In 2001, General Industries Corp. acquired the 30% of Ducab that had been held by Balfour Beaty plc of the United Kingdom.

The UAE was a notable international gold trading center. In 2001, the Gold and Diamond Park, which was a jewelry manufacturing free-trade zone in Dubai, was opened. Gold refining was carried out by Emirates Gold LLC's 50-t/yr refinery in Dubai and the Ary Group's 30-t/yr refinery in Sharjah (Gulf Industry, 2002§). A new free-trade zone dedicated to the gold trade was proposed for Dubai.

In 2001, construction of the Emirates Iron and Steel Factory's $82 million rebar rolling mill, which is located 35 km south of Abu Dhabi, was completed. The 500,000-t/yr-design-capacity plant was expected to start production in 2002 at a rate of about 250,000 t/yr. At yearend, General Industries Corp. proposed a $30 million expansion of Emirates Iron and Steel Factory into the production of wire rod and light sections (Ministry of Information and Culture, 2001a§). Construction of Ahli Steel Co.'s 450,000-t/yr-capacity steel plant and rebar rolling mill stalled because of financing difficulties (Metal Bulletin, 2001a).

Kemira Fertiliser Co. began urea production at its $14 million 30,000-t/yr-capacity plant in the Jebel Ali free zone, Dubai, in March (Middle East Economic Digest, 2001l). Also in Jebel Ali, construction continued on the $180 million 400,000-t/yr urea and 226,000-t/yr ammonia plant of the SPIC Fertilisers and Chemicals (a joint venture of Southern Petrochemical Industries Corp. of India and the local Emirates Trading Agency) (Middle East Economic Digest, 2001f). Proposed industrial mineral projects in the UAE included a $130 million 1.6-Mt/yr petroleum coke facility in Dubai, an $80 million 120-km liquid sulfur pipeline in Abu Dhabi from the onshore Habshan gas plant to Ruwais, and a $179 million 50,000-t/yr titanium dioxide facility in Dubai (Asia Chemical News, 2001, 2002a; Middle East Economic Digest, 2001o; Ministry of Information and Culture, 2001b§).

General background information on the oil and gas sector is available from the U.S. Energy Information Administration (2001b§).

YEMEN

Crude oil production has been a significant segment of the Yemeni economy since the mid-1990s. Oil and gas production accounted for an estimated 30.2% of the $9.1 billion[8] GDP in 2001 compared with 36.5% of the $9.3 billion GDP in 2000. Crude oil refining accounted for about 2.5% of the GDP; this was down from about 3% of the GDP in the mid-1990s. The contribution of mining and quarrying to the GDP also has dropped in the past few years. In 2001, mining accounted for about 0.15% of the GDP (Central Bank of Yemen, 2001§).

In 2001, the evaluation of Al-Jabail zinc deposit by ZincOx Resources plc of the United Kingdom indicated resources of 9.4 Mt of oxide ore with an average grade of 10.8% zinc, 2.3% lead, and 76.8 g/t silver (Metal Bulletin, 2002). Cantex Mine Development Corp. continued sampling across the Wadi Qutabah massive sulfide deposit, which is located about 23 km north of the Suwar deposit. Both deposits were covered by Cantex's Northwest Yemen exploration license. Cantex continued to seek a joint-venture partner to fund additional exploration and development of the deposits.

Privatization of the state-owned General Corp. for Cement Production and Marketing, which operated cement plants at Amran, Bajil, and Taiz, was postponed. It subsequently proposed an expansion of the clinker production capacity of the Amran plant to 1.7 Mt/yr from 520,000 t/yr (Middle East Economic Digest, 2001m).

A review of the oil and gas sector of Yemen during 2001 is available from the U.S. Energy Information Administration (2002§).

References Cited

Asia Chemical News, 2001, Dubai govt woos chemical investors: Asia Chemical News, v. 8, no. 333, November 5, p. 24.

Asia Chemical News, 2002a, Jamal studies coker + MTO: Asia Chemical News, v. 8, no. 346, February 25, p. 19.

Asia Chemical News, 2002b, Qatar + Shell in LoI: Asia Chemical News, v. 8, no. 346, February 25, p. 21.

Bahrain Monetary Agency, 2002, Quarterly statistical bulletin: Manama, Bahrain, Bahrain Monetary Agency, March, p. 27.

Bulk Materials International, 2000, Oman fertilisers: Bulk Materials International, no. 65, July-August, p. 6.

Dubai Aluminium Co. Ltd., 2002, Dubal announces major upgrade: Dubai, United Arab Emirates, Dubai Aluminium Co. Ltd. press release, June 19, 2 p.

Ivanhoe Energy Inc., 2002, Ivanhoe energy undertakes joint commercialization study in Japan for Qatar GTL project: Bakersfield, California, Ivanhoe Energy Inc. press release, March 11, 1 p.

[8]Where necessary, values have been converted from Yemeni rials (YR) to U.S. dollars (US$) at the exchange rate of YR168.69=US$1.00 for 2001.

Digitized by Google

McDowall, 2001, Off the back burner: Middle East Economic Digest, v. 45, no. 35, August 31, p. 6.
Metal Bulletin, 2000, Alba is likely to proceed with smelter expansion: Metal Bulletin, no. 8488, June 29, p. 3.
Metal Bulletin, 2001a, Ahli Steel awaits refinancing: Metal Bulletin, no. 8600, August 16, p. 17.
Metal Bulletin, 2001b, Balexco makes plans to build Qatar's first extrusion plant: Metal Bulletin, no. 8592, July 16, p. 5.
Metal Bulletin, 2001c, Commissioning begins at Kuwait rebar mill: Metal Bulletin, no. 8626, November 19, p. 18.
Metal Bulletin, 2002, ZincOx Resources sees loss in 2001: Metal Bulletin, no. 8682, June 13, p. 6.
Middle East Economic Digest, 2001a, Bidding to start on KOC project: Middle East Economic Digest, v. 45, no. 28, July 12, p. 9.
Middle East Economic Digest, 2001b, Bids invited for stone crusher: Middle East Economic Digest, v. 45, no. 30, July 27, p. 16.
Middle East Economic Digest, 2001c, BNP Paribas set for RasGas IV mandate: Middle East Economic Digest, v. 45, no. 35, August 31, p. 9.
Middle East Economic Digest, 2001d, Contract awarded for Mina al-Ahmadi repair: Middle East Economic Digest, v. 45, no. 31, August 3, p. 10.
Middle East Economic Digest, 2001e, Contract awarded for new urea unit at Shuaiba: Middle East Economic Digest, v. 45, no. 25, June 22, p. 13.
Middle East Economic Digest, 2001f, Dubai commits SPIC gas supply: Middle East Economic Digest, v. 45, no. 11, March 16, p. 15.
Middle East Economic Digest, 2001g, Expansion nears competition at Ducab: Middle East Economic Digest, v. 45, no. 17, April 27, p. 15.
Middle East Economic Digest, 2001h, ExxonMobil to head gas pipeline project: Middle East Economic Digest, v. 45, no. 12, March 23, p. 9.
Middle East Economic Digest, 2001i, Merger talks for proposed aluminium rolling mills: Middle East Economic Digest, v. 45, no. 18, May 4, p. 15.
Middle East Economic Digest, 2001j, Muscat ups its proven gas reserves estimates: Middle East Economic Digest, v. 45, no. 32, August 10, p. 9.
Middle East Economic Digest, 2001k, News in brief—Qatar: Middle East Economic Digest, v. 45, no. 41, October 12, p. 10.
Middle East Economic Digest, 2001l, The future is bright for Finnish company: Middle East Economic Digest, v. 45, no. 35, August 31, p. 10.
Middle East Economic Digest, 2001m, Three bid for Amran cement: Middle East Economic Digest, v. 45, no. 35, August 31, p. 15.
Middle East Economic Digest, 2001n, Three line up for Qatargas debottlenecking: Middle East Economic Digest, v. 45, no. 28, July 13, p. 9.
Middle East Economic Digest, 2001o, Gasco sulphur pipeline takes shape: Middle East Economic Digest, v. 45, no. 38, September 21, p. 10.
Middle East Economic Digest, 2001p, HSBC signs up on new fertiliser project: Middle East Economic Digest, v. 45, no. 5, February 2, p. 6.
Middle East Economic Digest, 2001q, KNPC to boost refinery output: Middle East Economic Digest, v. 45, no. 35, August 31, p. 10.
Middle East Economic Digest, 2001r, QP and UOG sign up for Dolphin: Middle East Economic Digest, v. 45, no. 12, March 23, p. 10.
Middle East Economic Digest, 2001s, QP signs up for second GTL plant: Middle East Economic Digest, v. 45, no. 26, June 29, p. 10.
Middle East Economic Digest, 2001t, Uncertain times: Middle East Economic Digest, v. 45, no. 17, April 27, p. 23-37.
Mining Journal, 2001, Dubal expansions under scrutiny: Mining Journal, v. 337, no. 8660, November 16, p. 361.
Norsk Hydro ASA, 2001, Qafco 4 project in Qatar approved by owners: Oslo, Norway, Norsk Hydro ASA press release, September 11, 1 p.
Qatar Petroleum, 2001, Qatar Petroleum and Sasol sign joint venture agreement for the Pioneer GTL plant in Qatar: Doha, Qatar, Qatar Petroleum press release, July 10, 2 p.
Stell, Jeannie, ed., 2000, Worldwide construction—Pipelines: Oil & Gas Journal, v. 98, no. 44, p. 90.

Internet References Cited

Aluminium Bahrain B.S.C., 2001a (October), Main news—Line 5 expansion project approved, Albayan Newsletter, accessed July 5, 2002, at URL http://www.aluminiumbahrain.com/news/octnews1-2001.htm.
Aluminium Bahrain B.S.C., 2001b (December), News on the plant—Kiln demolition is well underway, Albayan Newsletter, accessed July 5, 2002, at URL http://www.aluminiumbahrain.com/news/decnews2-2001.htm.
Aluminium Bahrain B.S.C., 2002, A review of 2001, accessed July 5, 2002, at URL http://www.aluminiumbahrain.com/review2001/chairman2001.htm.
Australian Department of Foreign Affairs & Trade, 2002, Bahrain factsheet, accessed September 3, 2002, at URL http://www.dfat.gov.au/geo/fs/bhrn.pdf.
Central Bank of Kuwait, 2002 (June), Quarterly statistical bulletin, accessed September 3, 2002, at URL http://www.cbk.gov.kw/WWW/index.html.
Central Bank of Yemen, 2001, Annual report, accessed July 11, 2002, via URL http://www.centralbank.gov.ye/index.htm.
Emirates News Agency, 2002 (June 6), Abu Dhabi's non-oil trade grows 2.2% in 2001, accessed June 6, 2002, at URL http://www.middleeastwire.com:8080/printarticle.jsp?id=10857.
Gulf Industry, 2002 (May-June), UAE review—DMCC sparks interest among gold refiners, accessed September 9, 2002, at URL http://www.gulfindustryworldwide.com/bkArticlesF.asp?IssueID=204&Section=203&Article=1510.
Kingdom of Bahrain, 2002, Foreign trade statistics, accessed August 26, 2002, via URL http://www.bahrain.gov.bh.
Madhavan, Adarsh, 2002 (August 31), Mineral sector has great potential to boost economy, Times of Oman, accessed September 11, 2002, at URL http://www.timesofoman.com/print.asp?newsid=13149.
Middle East Newsline, 2002 (April 25), Oman discovered new oil reserve, accessed May 10, 2002, at URL http://www.menewsline.com/stories/2002/april/04_26_02.html.
Ministry of Information and Culture, 2001a, The economy—Industrial development—Steel plant to start in 2002, News Archive, accessed September 9, 2002, at URL http://www.uaeinteract.com/news/default.asp?cntDisplay=1-&ID=17.
Ministry of Information and Culture, 2001b, The economy—Industrial development—Three projects worth US290m to be set up, News Archive, accessed September 9, 2002, at URL http://www.uaeinteract.com/news/default.asp?cntDisplay=1-&ID=17.
Orient Consulting Center, [undated]a, Kuwait stock market analysis—Gulf Glass Company, accessed July 16, 2002, at URL http://www.occkw.com/English/search/search_co.asp.
Orient Consulting Center, [undated]b, Kuwait Cement Company, News Data Bank, accessed July 16, 2002, at URL http://www.occkw.com/English/search/search_co.asp.
Qatar Central Bank, 2002 (March), Economic data—Periodic statement—Main economic indicators, accessed July 11, 2002, via URL http://www.qcb.gov.qa/pages/SEP2001/Main_Economic_Indicators.html.
Shuaa Capital P.S.C., 2002 (September 9), UAE's GDP at Dh234b in '01, says Petroleum Ministry, accessed September 9, 2002, at URL http://www.shuaacapital.com/shuaacapital/news/FinancialNews.aspx.
U.S. Energy Information Administration, 2001a (May), Oman, Country Analysis Brief, accessed July 9, 2001, at URL http://www.eia.doe.gov/emeu/cabs/ oman2.html.
U.S. Energy Information Administration, 2001b (November), United Arab Emirates, Country Analysis Brief, accessed July 15, 2002, at URL http://www.eia.doe.gov/emeu/cabs/uae.html.
U.S. Energy Information Administration, 2002 (March), Yemen, Country Analysis Brief, accessed July 15, 2002, at URL http://www.eia.doe.gov/emeu/ cabs/yemen.html.
U.S. Energy Information Administration, [undated], Table 1.1—World crude oil production [including lease condensate]—1990-present, accessed September 4, 2002, at URLs http://www.eia.doe.gov/emeu/ipsr/t11a.txt; http://www.eia.doe.gov/emeu/ipsr/t11b.txt; and http://www.eia.doe.gov/emeu/ipsr/t11c.txt.

General Sources of Information

Bahrain Ministry of Oil and Industry
P.O. Box 1435
Manama
Bahrain
Telephone: (+973) 525-521
Fax: (+973) 290-294

Digitized by Google

Kuwait Ministry of Oil
P.O. Box 5077
Safat 13051
Kuwait
Telephone: +(965) 241-5201
Fax: +(965) 241-7088

Oman Ministry of Commerce and Industry
Directorate of Minerals
P.O. Box 550
Muscat 113
Oman
Telephone: +(968) 771-3500
Fax: +(968) 771-7238

Oman Ministry of Petroleum and Gas
P.O. Box 551
Muscat 113
Oman
Telephone: +(968) 603-333

Qatar Ministry of Energy and Industry
P.O. Box 3212
Doha
Qatar
Telephone: +(974) 449-1491
Fax: +(974) 483-6999

United Arab Emirates Ministry of Petroleum and Mineral Resources
P.O. Box 59
Abu Dhabi
United Arab Emirates
Telephone: +(971) 2-667-1999
Fax: +(971) 2-666-3414

Yemen Ministry of Oil and Mineral Resources
P.O. Box 81
Alzubaeri St.
Sana'a
Yemen
Telephone: +(967) 1-202-309
Fax: +(967) 1-202-314

TABLE 1
BAHRAIN, KUWAIT, OMAN, QATAR, THE UNITED ARAB EMIRATES, AND YEMEN: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1997	1998 e/	1999 e/	2000 e/	2001 e/
BAHRAIN 2/						
Aluminum, smelter output, primary metal		489,847	501,308 3/	502,663 3/	509,038 3/	510,000
Cement		171,854	230,422	156,100 3/	88,806 3/	88,700 3/
Gas, natural:						
Gross	million cubic meters	10,625	11,120	11,470 3/	11,500	12,100
Dry	do.	8,000	8,500	8,789 3/	8,966 3/	9,285 3/
Methanol		447,969	384,111 3/	421,946 3/	370,000 3/	412,122 3/
Natural gas plant liquids:						
Propane	thousand 42-gallon barrels	1,213	1,192 3/	1,144 3/	1,055 3/	1,058 3/
Butane	do.	1,048	1,024 3/	1,005 3/	955 3/	968 3/
Naphtha	do.	1,716	1,661 3/	1,683 3/	1,626 3/	1,598 3/
Nitrogen, N content of ammonia		355,900	335,900 3/	369,500 3/	349,900 3/	372,000 3/
Petroleum:						
Crude	thousand 42-gallon barrels	14,159	13,750	13,670 3/	13,766 3/	13,656 3/
Refinery products: e/						
Liquefied petroleum gas	do.	300 e/	300 e/	335 3/	346 3/	353 3/
Gasoline	do.	7,377 3/	6,344 3/	6,756 3/	7,090 3/	6,182 3/
Jet fuel	do.	6,500	9,125 3/	9,520	9,450	15,497 3/
Kerosene	do.	17,501 3/	8,030 3/	9,000	9,000	2,777 3/
Distillate fuel oil	do.	32,074 3/	31,591 3/	30,000	21,278 r/ 3/	17,188 3/
Residual fuel oil	do.	20,800 e/	19,719 3/	22,066 3/	29,000	25,000
Other	do.	19,700 e/	19,700	16,700	16,500	17,000
Total	do.	104,000	94,800	94,400	92,700	84,000
Sulfur		66,334	66,500	66,500	61,590 3/	67,480 3/
KUWAIT 4/						
Cement e/		2,000,000	1,345,000 r/	1,435,000 r/	1,540,000 r/	1,600,000
Lime, hydrated and quicklime e/		40,000	40,000	40,000	40,000	40,000
Natural gas: 5/						
Gross	million cubic meters	10,870	11,100	10,144 3/	11,000	10,900
Dry	do.	9,250	9,500	8,688 3/	9,600 r/	9,500
Natural gas liquids e/	thousand 42-gallon barrels	37,000	37,000	38,000	41,100 r/	44,300
Nitrogen:						
N content of ammonia		432,000	452,300 3/	396,800 3/	409,500 3/	420,000
N content of urea		348,500	361,300 3/	330,900 3/	287,600 3/	290,000

See footnotes at end of table.

Digitized by Google

TABLE 1--Continued
BAHRAIN, KUWAIT, OMAN, QATAR, THE UNITED ARAB EMIRATES, AND YEMEN: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1997	1998 e/	1999 e/	2000 e/	2001 e/
KUWAIT--Continued 4/						
Petroleum:						
Crude 5/	thousand 42-gallon barrels	760,295	761,025 3/	708,000	766,000 r/	745,000
Refinery products:						
Gasoline, motor	do.	15,475	17,520 3/	17,000	10,000	10,000
Kerosene	do.	49,303	51,470 3/	50,000	35,000	30,000
Distillate fuel oil	do.	96,754	91,980 3/	92,000	75,000 r/	70,000
Residual fuel oil	do.	82,270	75,550 3/	72,000	60,000 r/	60,000
Other	do.	58,882	86,870 3/	80,000	70,000 r/	70,000
Total	do.	302,684	323,390	311,000	250,000 r/	240,000
Salt		100,000 e/	100,000	100,000	100,000	100,000
Sulfur:						
Elemental, petroleum byproduct		625,000 r/	650,000 r/	639,000 r/	512,000 r/	524,000
Sulfuric acid e/		10,000	10,000	10,000	100,000 r/	150,000
OMAN						
Cement, hydraulic		1,264,000	1,333,000 r/ 3/	1,217,000 r/ 3/	1,238,063 r/ 3/	1,369,570 3/
Chromite, gross weight		18,000	28,684 3/	26,004 3/	15,110 3/	30,100 3/
Copper, metal						
Smelter		22,800	24,400 3/	16,818 3/	23,790 3/	24,220 3/
Refinery		23,600	22,700	17,171 3/	24,281 3/	24,000
Gas, natural:						
Gross	million cubic meters	10,202 r/ 3/	10,396 r/ 3/	11,567 r/ 3/	15,496 r/ 3/	17,200
Dry	do.	7,879 r/ 3/	7,784 r/ 3/	8,056 r/ 3/	12,020 r/ 3/	13,400
Gold	kilograms	577	891 r/ 3/	884 r/ 3/	1,029 r/ 3/	1,000
Gypsum		113,600	189,507 r/ 3/	180,129 3/	131,909 3/	30,000 3/
Natural gas liquids e/	thousand 42-gallon barrels	3,800	4,000	6,000	6,000	6,000
Petroleum:						
Crude	do.	329,960	328,500 3/	328,100 3/	340,000 r/	352,000
Refinery products:						
Liquefied petroleum gas	do.	316 r/	395 r/ 3/	423 r/ 3/	350	250
Gasoline	thousand 42-gallon barrels	4,082 r/	5,224 r/ 3/	4,711 r/ 3/	4,857 r/ 3/	3,400
Jet fuel and kerosene	do.	1,038 r/	1,127 r/ 3/	1,457 r/ 3/	1,643 r/ 3/	1,200
Distillate fuel oil	do.	4,854 r/	6,029 r/ 3/	6,297 r/ 3/	6,363 r/ 3/	4,500
Residual fuel oil	do.	12,669 r/	14,950 r/ 3/	14,900 r/ 3/	14,800 r/ 3/	10,400
Other e/	do.	794 r/	947 r/ 3/	908 r/ 3/	641 r/ 3/	400
Total e/	do.	23,437	28,277 r/	28,273 r/	28,304 r/	20,200
Sand and gravel		9,800,000	9,800,000	15,681,951 3/	22,448,254 3/	23,000,000
Silver	kilograms	3,471 r/	4,692 r/ 3/	3,366 r/ 3/	4,894 r/ 3/	3,153 3/
Stone:						
Marble		169,000	115,748 r/ 3/	188,545 3/	147,686 3/	156,000 3/
Other		1,992,000	2,381,143 r/ 3/	3,813,821 3/	3,537,216 3/	3,294,000 3/
Sulfur e/		30,000	30,000	30,000	30,000	30,000
QATAR 6/						
Cement, hydraulic		692,000	986,000 r/	1,025,000 3/	1,050,000	1,050,000
Gas, natural:						
Gross	million cubic meters	24,210	26,200	32,000	33,656 r/ 3/	37,132 6/
Dry	do.	17,270	19,540 3/	24,000	26,141 r/ 3/	27,738 3/
Iron and steel, metal:						
Direct-reduced iron		570,000	706,000 3/	670,000	620,962 r/ 3/	733,549 3/
Steel, crude		616,000	646,000 3/	629,000	743,615 r/ 3/	907,608 3/
Semimanufactures:						
Billet		608,000	637,000 3/	600,000 r/	728,780 r/ 3/	891,117 3/
Bars		596,000	597,000 3/	600,000	579,525 r/ 3/	713,500 3/
Natural gas liquids	thousand 42-gallon barrels	50,000 r/	50,000 r/	49,000 r/	24,126 r/ 3/	26,726 3/
Nitrogen:						
N content of ammonia		942,500	1,127,300 3/	1,129,600 3/	1,097,000 3/	1,159,118 3/
N content of urea		670,000	767,000 3/	757,000 3/	770,761 r/ 3/	779,388 3/
Petroleum:						
Crude	thousand 42-gallon barrels	236,885	254,040 3/	232,000	231,000 r/ 3/	237,000 3/
Refinery products:						
Gasoline	do.	4,380	5,100	5,400	4,521 r/ 3/	4,948 3/
Kerosene	do.	3,285	3,300	3,900	2,997 r/ 3/	3,911 3/
Distillate fuel oil	do.	5,110	5,100	4,900	4,490 r/ 3/	3,824 3/

See footnotes at end of table.

Digitized by Google

TABLE 1--Continued
BAHRAIN, KUWAIT, OMAN, QATAR, THE UNITED ARAB EMIRATES, AND YEMEN: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity		1997	1998 e/	1999 e/	2000 e/	2001 e/
QATAR--Continued						
Petroleum--Continued:						
Refinery products--Continued:						
Residual fuel oil	thousand 42-gallon barrels	6,205	6,900	6,750	6,264 r/ 3/	4,492 3/
Other	do.	5,840	2,200	1,600	736 r/ 3/	514 3/
Total	do.	24,820	22,600	22,600 r/	19,008 r/	17,689
Stone, limestone e/		900,000	900,000	900,000	900,000	900,000
Sulfur e/		73,000	146,000	155,000	190,868 r/ 3/	220,824 3/
UNITED ARAB EMIRATES 7/						
Aluminum, primary		381,000	352,000	440,000	470,000	500,000
Cement, hydraulic e/		6,330,000 r/	7,066,000 r/ 3/	7,069,000 r/ 3/	6,100,000	6,100,000
Chromite, gross weight		61,000	76,886 3/	60,000	30,000 r/	10,000
Gas, natural:						
Gross	million cubic meters	48,500	48,980 3/	50,200 3/	52,000	54,000
Dry	do.	36,310	37,070 3/	38,500	39,800 r/	41,300
Gypsum e/		90,000	90,000	90,000	90,000	90,000
Lime e/		50,000	50,000	50,000	50,000	50,000
Natural gas plant liquids e/	thousand 42-gallon barrels	80,000 r/	80,000 r/	80,000 r/	80,000 r/	80,000
Nitrogen:						
N content of ammonia		372,500	331,000 3/	380,200 3/	348,400 3/	350,000
N content of urea		303,520	259,000	271,500 3/	243,400 3/	244,000
Petroleum:						
Crude	thousand 42-gallon barrels	845,340	880,000	756,000	815,000 r/	790,000
Refinery products:						
Gasoline	do.	12,812	13,100	12,800	13,000	13,000
Kerosene	do.	24,419	21,200	21,000	21,000	21,000
Distillate fuels	do.	27,521	24,500	24,400	25,000	25,000
Residual fuels	do.	17,812	13,500	12,300	12,500	12,500
Other	do.	26,061	19,700	10,700	11,000	11,000
Total	do.	108,625	92,000	81,200	82,500 r/	82,500
Steel e/		70,000	70,000	70,000	70,000	70,000
Sulfur, byproduct of petroleum refining and natural gas processing e/		967,000 3/	967,000 3/	1,089,000 3/	1,122,000 r/ 3/	1,400,000
YEMEN						
Cement		1,235,000	1,201,404 3/	1,453,787 3/	1,400,000	1,400,000
Gypsum		101,000	102,000 3/	103,000 3/	100,000	100,000
Marble	thousand square meters	84	86 3/	88 3/	86	86
Natural gas: e/						
Gross 8/	million cubic meters	13,500	15,000	16,000	18,000	18,000
Liquids	thousand 42-gallon barrels	1,800	2,000	2,200	2,400	2,400
Petroleum:						
Crude	do.	125,560	138,600 3/	149,000	167,000	165,000
Refinery products:						
Gasoline	do.	8,803	9,100 3/	9,100	9,100	9,100
Kerosene	do.	4,073	3,700 3/	3,700	3,700	3,700
Distillate fuel oil	do.	10,530	6,900 3/	6,900	6,900	6,900
Residual fuel oil e/	do.	10,300	10,600	10,600	10,600	10,600
Other e/	do.	2,000	3,700 3/	3,700	3,700	3,700
Total	do.	35,706	34,000 3/	34,000	34,000	34,000
Salt		136,000	147,000 3/	149,000 3/	150,000	150,000
Stone, dimension	thousand cubic meters	2,485	2,497 3/	2,547 3/	2,500	2,600

e/ Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. r/ Revised.

1/ Table includes data available through September 2002.

2/ In addition, iron ore was pelleted and exported for use by direct reduction plants. Pellets were produced from imported iron ore. Production was, in million metric tons: 1997--3.23; 1998--1.9; 1999--2.7; and 2000--3.7. Since 1998, granular urea has been produced from locally produced ammonia.

3/ Reported figure.

4/ In addition to commodities listed, caustic soda, chlorine, clays, clay products, and sand and gravel are produced, but available information is inadequate to make estimates of output.

5/ Includes Kuwait's share of production from the partitioned zone.

6/ In addition to commodities listed, clays, gypsum, and sand and gravel for construction purposes and methanol are produced, but available information is inadequate to make estimates of output.

7/ In addition to the commodities listed, crude industrial minerals, such as common clays, diabase, gravel, limestone, marble, sand and shale, presumably are produced, but output is not reported, and information is inadequate to make estimates of output.

8/ Most produced associated natural gas was stripped of liquids and reinjected.

Digitized by Google

TABLE 2
BAHRAIN, KUWAIT, OMAN, QATAR, AND YEMEN: STRUCTURE OF THE MINERAL INDUSTRIES IN 2001

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
BAHRAIN				
Aluminum		Aluminium Bahrain B.S.C. (Government)	Smelter at Sitra	510,000
Do.		Gulf Aluminium Rolling Mill B.S.C. (Closed) (Government of Bahrain, 38%; Saudi Basic Industries Corp., 30%; Industrial Bank of Kuwait, 17%; Gulf Investment Corp. of Kuwait, 6%; Government of of Iraq, 5%; Government of Oman, 2%; Government of Qatar, 2%)	Rolling mill at Sitra	120,000
Ammonia		Gulf Petrochemical Industries Co. (Government of Bahrain, Petrochemical Industries Co. of Kuwait, and Saudi Basic Industries Corp.)	Sitra	450,000
Cement		Hundai Cement Factory	Clinker mills at Muharroq	438,000
Iron ore, pellets		Gulf Industrial Investment Co. (Gulf Investment Corp. of Kuwait and Rio Doce International Finance Ltd.)	Pellet plant at Al-Hidd	4,000,000
Methanol		Gulf Petrochemical Industries Co. (Government of Bahrain, Petrochemical Industries Co. of Kuwait, and Saudi Basic Industries Corp.)	Sitra	365,000
Natural gas 1/	million cubic meters	Bahrain National Gas Co. B.S.C. (Government, 75%; Caltex Trading and Transport Co. of Bahrain, 12.5%; Arab Petroleum Investments Corp. of Saudi Arabia, 12.5%)	Awali Field	12,000
Natural gas liquids 2/	million barrels	do.	Gas processing trains at Awali and Jabal al-Dukhan	4
Petroleum, crude	barrels per day	Bahrain Petroleum Co., B.S.C. (closed) (Government)	Awali Field	38,000
Petroleum products	do.	do.	Refinery at Sitra	248,900
Sulfur 3/		do.	Sitra	69,000
Urea		Gulf Petrochemical Industries Co. (Government of Bahrain, Petrochemical Industries Co. of Kuwait, and Saudi Basic Industries Corp.)	do.	620,000
KUWAIT				
Ammonia		Petrochemical Industries Co. (Kuwait Petroleum Co.)	Plant B, Shuaiba	657,000 4/
Cement		Kuwait Cement Co. (Kuwait Investment Authority, 32.3%)	Kilns and mills at Shuaiba	1,800,000 5/
Coke, petroleum		Kuwait National Petroleum Co. K.S.C. (Kuwait Petroleum Co.)	Mina Abdulla refinery	890,000
Natural gas 1/	million cubic meters	All oil production operations produce some natural gas	Various fields	11,000
Natural gas liquids	barrels	Kuwait Oil Co. K.S.C. (Kuwait Petroleum Co.)	Liquefied petroleum gas processing trains at Mina al-Ahmadi and fractionation plant at Shuaiba	38,000,000
Petroleum, crude	barrels per day	Kuwait Oil Co. K.S.C.	Abdali, Abdiliyah, Bahra, Burgan, Dhafir, Kashman, Magwa, Minagish, Ratga, Riquah, Sabiyah, and Umm Gudair Fields	2,000,000
Do.	do.	Saudi Arabian Texaco Inc. (ChevronTexaco Corp.)	South Fuwaris and South Umm Gudair Fields, partitioned neutral zone	250,000 6/
Do.	do.	Kuwait Oil Co. K.S.C. and Saudi Arabian Texaco Inc.	Wafra Field, partitioned neutral zone	(6/)
Do.	do.	Arabian Oil Co., Ltd. (consortium includes Kuwait Petroleum Co., Government of Saudi Arabia, Tokyo Electric Power Co., Inc., and Kansai Electric Power Co., Inc.)	Hout-Ratawi Field, offshore partitioned neutral zone	280,000 7/
Do.	do.	Al-Khafji Joint Operations [Arabian Oil Co., Ltd. and Aramco Gulf Operations Co. (Saudi Arabian Oil Co.)]	Khafji Field, offshore partitioned neutral zone	(7/)
Petroleum products	do.	Kuwait National Petroleum Co. K.S.C. (Kuwait Petroleum Co.)	Refinery at Mina al-Ahmadi	300,000 8/
Do.	do.	do.	Refinery at Mina Abdulla	255,000
Do.	do.	do.	Refinery at Shuaiba	199,000
Salt		Salt and Chlorine Factory (Al Ahlia Investment Co.)	Shuwaikh	NA
Do.		do.	Shuaiba	NA
Steel		United Steel Industrial Co. (National Iranian Steel Co., 49% and Kuwaiti investors, 51%).	Reinforcing bar rolling mill	300,000 9/
Sulfur		Kuwait National Petroleum Co. K.S.C.	Mina Abudulla, Mina al-Ahmadi, and Shuaiba.	1,320,000
Urea		Petrochemical Industries Co.	Plants A and B, Shuaiba	400,000 10/

See footnotes at end of table.

Digitized by Google

TABLE 2--Continued
BAHRAIN, KUWAIT, OMAN, QATAR, AND YEMEN: STRUCTURE OF THE MINERAL INDUSTRIES IN 2001

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
OMAN			
Cement	Oman Cement Co.	Kilns and mills at Rusayl	1,200,000
Do.	Raysut Cement Co.	Kilns and mills at Salalah	750,000
Chromite	Oman Chromite Co.	Mine at the Ghashabi-2 deposit.	29,000
Copper	Oman Mining Co. LLC	Smelter and refinery near Sohar.	24,400
Gold kilograms	do.	Rakah near Yankul	2,100
Marble	Omani Marble Co. LLC [Omar Zawawi Establishment)	Quarries at Ibri	NA
Natural gas cubic meters	Petroleum Development Oman LLC [Government of Oman, 60%; Royal Dutch/Shell Group, 34%; POHOL (TotalFinaElf Group), 4%; and Partex Corp., 2%]	About 97 fields including Al Noor, Barik, Burhaan, Fahud Northwest, Lekwair, Maramul, Mukhaizna, Nimr, Rima, Saih-Nihayda, Saih-Rawl, and Yibal	3,300,000,000
Natural gas, liquefied (LNG)	Oman Liquefied Natural Gas LLC	Two LNG trains at Qalhat	6,600,000
Petroleum, crude barrels per day	Petroleum Development Oman LLC [Government of Oman, 60%; Royal Dutch/Shell Group, 34%; POHOL (TotalFinaElf Group), 4%; and Partex Corp., 2%]	About 97 fields including Al Noor, Burhaan, Fahud Northwest, Lekwair, Marmul, Mukhaizna, Nimr, Rima, and Yibal	840,000
Do. do.	Occidental Oman Inc. (Occidental Petroleum Corp.), 65%; and Fortum (E&P) B.V. (Fortum Oil and Gas Oy of Finland) 11/	Safah Field, block 9	21,500
Do. do.	Japex Oman Ltd. and Japex Aswad Ltd. (Japan Petroleum Exploration Co., Ltd. of Japan)	Block 5	9,000
Do. do.	Novus Bukha Ltd. [Novus Petroleum Ltd. Of Australia), 40%; LG International Corp. of Korea, 30%; Eagle Energy Ltd. of Oman (Heritage Oil Corp. of Canada)]	Bukha Field, block 8	3,500
Do. do.	Petrogas LLC (MB Petroleum Services LLC of Oman)	Block 7	2,000
Petroleum products do.	Oman Refinery Co.	Mina Al-Fahal	85,000
Silver kilograms	Oman Mining Co. LLC	Rakah near Yankul	300
QATAR			
Ammonia	Qatar Fertilizer Co. Ltd. (Qatar Petroleum, 75%; Norsk Hydro ASA, 25%)	QAFCO I, Mesaieed	416,000
Do.	do.	QAFCO II, Mesaieed	420,000
Do.	do.	QAFCO III, Mesaieed	548,000
Do.	do.	QAFCO IV, Mesaieed	730,000 9/
Cement	Qatar National Cement Co.	Kilns and mills at Umm Bab	908,000
Do.	Al-Jabor Cement Industries Co.	Clinker grinding mill at Doha	165,000
Clay	Qatar Clay Bricks Co.	NA	10,000
Iron, direct reduced	Qatar Steel Co. Ltd. (Government, 100%)	Mesaieed	730,000
Lime	Qatar National Cement Co.	Kilns at Umm Bab	NA
Methanol	Qatar Fuel Additives Co. Ltd. (Qatar Petroleum, 50%; Chinese Petroleum Corp. of Taiwan, 20%; Lee Chang Yung Chemical Industrial Corp. of Taiwan, 15%; International Octane Ltd., 15%).	Mesaieed	825,000
Natural gas cubic meters per day	Qatar Petroleum	North Field, offshore	11,300,000
Do. do.	Qatar Liquefied Gas Co. [Qatar Petroleum, 65%; TotalFinaElf Group, 20%; Mobil Qatargas Inc. (Exxon Mobil Corp.), 10%; Marubeni Corp. of Japan, 2.5%; Mitsui & Co. Ltd. of Japan, 2.5%]	do.	40,000,000
Do. do.	Ras Laffan Liquefield Natural Gas Co. Ltd. (Qatar Petroleum, 63%; Mobil QM Gas Inc, 25%; Korea Gas Corp., 5%, Itochu Corp., 4%; Nissho Iwai Co., 3%).	do.	28,000,000
Do. do.	Qatar Petroleum	Dukhan Field, onshore	9,600,000
Natural gas, liquefied	Qatar Liquefied Gas Co. (Qatar Petroleum, 65%; TotalFinaElf Group, 10%; Mobil Qatargas Inc. (Exxon Mobil Corp.), 10%; Marubeni Corp. of Japan, 7.5%; Mitsui & Co. Ltd. of Japan, 7.5%)	Three trains at Ras Laffan	7,700,000
Do.	Ras Laffan Liquefield Natural Gas Co. Ltd. (Qatar Petroleum, 63%; Mobil QM Gas Inc, 25%; Korea Gas Corp., 5%; Itochu Corp., 4%; Nissho Iwai Co., 3%)	Two trains at Ras Laffan	6,600,000

See footnotes at end of table.

Digitized by Google

TABLE 2--Continued
BAHRAIN, KUWAIT, OMAN, QATAR, AND YEMEN: STRUCTURE OF THE MINERAL INDUSTRIES IN 2001

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
QATAR--Continued				
Natural gas liquids	barrels	Qatar Liquefied Gas Co.	Ras Laffan	20,000,000
Do.	do.	Ras Laffan Liquefield Natural Gas Co. Ltd.	do.	16,000,000
Do.	do.	Qatar Petroleum	NGL-1, NGL-2, and NGL-3 at Mesaieed	15,000,000
Do.	do.	do.	NGL-4 at Mesaieed	27,000,000 9/
Petroleum, crude	do.	do.	Dukhan Field, onshore	120,000,000
Do.	do.	Maersk Oil Qatar A.S. (Maersk Olie og Gas A.S.)	Al Shaheen Field, offshore	45,000,000
Do.	do.	Occidental Petroleum of Qatar Ltd.	Idd Al Shargi North Dome	40,000,000
Do.	do.	Qatar Petroleum	Bul Hanine, offshore	25,000,000
Do.	do.	do.	Maydan Mahzam, offshore	18,000,000
Do.	do.	Elf Petroleum Qatar (TotalFinaElf Group), 55%; and Agip Qatar B.V. (Eni Group), 45%	Al Khaleej, offshore	11,000,000
Do.	do.	Occidental Petroleum of Qatar Ltd.	Idd Al Shargi South Dome	7,500,000
Do.	do.	BP plc (operator), 27.5%; Anadarko Petroleum Corp., 65%; Preussag Energie GmbH, 7.5% 12/	Al Rayyan, offshore	4,500,000
Petroleum products	do.	Qatar Petroleum	Mesaieed	24,000,000
Steel		Qatar Steel Co. Ltd. (Government, 100%)	Plant at Mesaieed	920,000 13/
Do.		do.	Rolling mill at Mesaieed	609,000
Sulfur		Qatar Petrochemical Co. Ltd. (Qatar Petroleum, 80%; Atofina, the Chemicals branch of the TotalFinaElf Group of France, 10%; and Enichem of the ENI Group of Italy, 10%)	Umm Said	70,000
Do.		Ras Laffan LNG Co.	Ras Laffan	55,000
Do.		Qatar Liquefied Gas Co. Ltd.	do.	45,000
Do.		Qatar Petroleum	Mesaieed	95,000
Urea		Qatar Fertilizer Co. Ltd. (Qatar Petroleum, 75%; Norsk Hydro ASA, 25%)	QAFCO I, Mesaieed	447,000
Do.		do.	QAFCO II, Mesaieed	511,000
Do.		do.	QAFCO III, Mesaieed	730,000
Do.		do.	QAFCO IV, Mesaieed	1,200,000 9/
YEMEN				
Cement		Amran Cement Factory (Yemen Cement Manufacturing and Marketing Co., 100%)	Kilns and mills at Amran	520,000
Do.		Bajil Cement Factory (Yemen Cement Manufacturing and Marketing Co., 100%)	Kilns and mills at Bajil	262,000
Do.		Al Barh Cement Factory (Yemen Cement Manufacturing and Marketing Co., 100%)	Kilns and mills at Taiz	480,000
Gypsum		NA	Near Salif	70,000
Natural gas 1/	million cubic meters	Yemen Exploration and Production Co., (operator) [Yemen Hunt Oil Co., 51%, (Hunt Oil Co. of the United States) and Exxon Yemen, Inc., 49% (Exxon Mobil Corp. of the United States)]	Primarily associated gas from the Marib/ Jawf and Jannah licenses, including the Alif, Al-Raja, Al-Sa'idah, and Jabal Barat Fields	16,000
Natural gas liquids	million barrels	do.	Primarily from gas associated with the Marib/Jawf licenses	NA
Petroleum, crude	barrels per day	Nexen Inc. of Canada, 52% (operator); Occidental Peninsula II, Inc. of St. Kitts & Nevis; and Consolidated Contractors International Ltd. of Greece	Block 14, Masila license, including the Camaal, Heijah, Sunah, and Tawila Fields	215,000
Do.	do.	Yemen Exploration and Production Co., (operator) [Yemen Hunt Oil Co., 51%, (Hunt Oil Co. of the United States) and Exxon Yemen, Inc., 49%, (Exxon Mobil Corp. of the United States)]	Block 18, Marib/Jawf license, including the Al-Shura, Al-Wihdah, Asad al-Kamil, Azal, Jabal Nuqum, Jabal Ras, Raydan, Saif Ben The-Yazen, Saharah, Suquatrah, and Wadi Bana Fields	129,000 14/
Do.	do.	Yemen Exploration and Production Co., 75.5% (operator) (Yemen Hunt Oil Co., 51% and Exxon Yemen, Inc., 49%), and Yukong consortia, 24.5% (SK Corp., 65%; Sam Wham Corp., 15%; Korean Petroleum Development Corp., 10%; Hyundai Corp., 10%)	Block 18, Marib/Jawf license, Alif Field	(14/)
Do.	do.	Jannah Hunt Oil Co., 15% (operator); Kuwait Foreign Petroleum Exploration Co., 20%; The Yemen Company, 20%; Exxon Yemen Inc., 15%; Russian interests, 15%; TotalFinalElf Group, 15%	Block 5, Jannah concession--Al-Nasr, Dhab, and Halewah Fields	75,000

See footnotes at end of table.

Digitized by Google

TABLE 2--Continued
BAHRAIN, KUWAIT, OMAN, QATAR, AND YEMEN: STRUCTURE OF THE MINERAL INDUSTRIES IN 2001

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
YEMEN--Contined.				
Petroleum, crude--Continued:	barrels per day	TotalFinaElf Group, 28.6% (operator); Complex Petroleum Holdings, 28.6%; Kuwait Foreign Petroleum Exploration Co., 14.3%; and Occidental Petroleum Corp., 28.6%	East Shabwa concession, block 10, including the Atuf North-West, Khair, and Wadi Taribah Fields	31,000
Do.	do.	Dove Energy Ltd. of Great Britain, 24.45% (operator); DNO International Yemen, 24.45%; MOE Oil & Gas, 16.10%; Petrolin Trading Ltd., 10%; and The Yemen Co., 25%	Block 53, Sharyoof Field	20,000
Do.	do.	DNO International Yemen (DNO ASA of Norway), 38.95% (operator); Ansan Wikfs Hadramaut Ltd., 42.93%; TG Holdings Yemen Inc. (TransGlobe Energy Corp. of Canada), 13.81%; and The Yemen Oil Co. (Government), 5%	Block 32, Tansour Field	8,200
Petroleum products	do.	Aden Refinery Co. (Government)	Refinery at Aden	70,000
Do.	do.	Yemen Refining and Marketing Co., 75.5% (Yemen Hunt Oil Co. and Exxon Mobil Corp.), and Yukong Group, 24.5%	Topping plant at Marib	10,000
Salt		Salt Refining and Packing Factory (Government)	Rock salt quarries near Salif	NA
Do.		Aden Salt Factory (Government)	Evaporation ponds at Aden	NA
Stone		Various local companies	Basalt and tuff quarries in the Dhamar, the Sana'a, and the Taiz areas; limestone from Wadi Marek and Mayana	NA

NA Not available.
1/ Associated gas.
2/ Processing train natural gas input capacity was 8 million cubic meters per day. Output includes butane, isobutane, naptha, and propane.
3/ Byproduct of oil and gas processing.
4/ Lines II and IV only. Line III (292,000-metric-ton-per-year-capacity) was idle.
5/ A 345,000-metric-ton-per-year capacity expansion program was nearly complete at yearend.
6/ Includes production from the Wafra Field.
7/ Includes production from the Hout-Ratawi Field.
8/ About 100,000-barrel-per-day refining capacity was out of commission because of a June 2000 explosion and fire. The damage was under repair.
9/ Under construction.
10/ Expansion of plant's urea capacity to 639,000 metric tons was underway in 2001.
11/ The effective date of the sale of Fortum (E&P) B.V.'s interest in Block 9 to Mitsui & Co. Ltd. and Mitsui Oil Exploation Co. Ltd. was December 31, 2001.
12/ Prior to May 1, 2001, BP plc was known as BP Amoco plc. Gulfstream Resources Canada Ltd. and its 65% equity interest in block 12 (which included the Al Rayyan Field) was purchased by Anadarko Petroleum Corp. in August 2001.
13/ Capacity expansion to 50,000,000 barrels per year was underway in 2001.
14/ Production from the Alif Field reported with other block 18 Maarib/Jawf license fields.

Digitized by Google

THE MINERAL INDUSTRY OF

CYPRUS

By Philip M. Mobbs

In 2001, the mineral industry of Cyprus[1] was dominated by the production of bentonite, cement, copper, and refined petroleum products. Other mineral commodities produced included clay, gypsum, sand and gravel, and stone for local use and gypsum, ocher, and umber for export. In 2001, exports of minerals and industrial products of mineral origin were valued at about $18 million.[2] Total domestic exports (excluding shipstores) were valued at $366 million. Imports of fuels for local consumption were valued at about $415 million (Statistical Service of Cyprus, 2002a§[3]). Mineral exports and imports transited through the ports of Larnaca, Limassol, and Vassiliko or the petroleum products terminals at Dhekelia, Larnaca, and Moni.

In 2001, Cyprus' gross domestic product was estimated to be $9.2 billion (Statistical Service of Cyprus, 2002b§). The census released in October 2001 tallied a population of 689,471. The Turkish Cypriot population was estimated to be about 88,000.

Government Policies and Programs

The Mines Service of the Ministry of Agricultural, Natural Resources, and Environment administered mineral operations under the Mines and Quarries (Regulation) Law, Chapter 270, 1959; the Mines and Quarries Regulations, 1958-79; and the Cyprus Standard and Control of Quality Law, 1975. Royalties on extracted mineral commodities ranged from 1% to 5%. The Ministry's Geological Survey Department was responsible for mineral exploration programs and the evaluation of the country's resources. The Environmental Service was responsible for coordinating the environmental efforts of the Government departments. The Republic of Cyprus Press and Information Office (2001§) reported that the preparation of a geological map of northern Cyprus by Maden Tetkik ve Arama Genel Müdürlügü of Turkey was underway.

Commodity Review

Copper and Gold.—Hellenic Copper Mines Ltd. [a consortium whose members included Hellenic Mining Company of Cyprus, Mytilineos Holdings S.A. of Greece, and Oxiana Europe Ltd. of the Channel Islands (a subsidiary of Oxiana Resources NL of Australia)] operated the Skouriotissa copper mine. In 2001, the Hellenic Copper mined 850,936 metric tons (t) of high-grade copper ore (0.60% Cu) and 863,716 t of low-grade ore (0.29% Cu). Copper cathode production was 5,176 t in 2001 compared with 5,197 t in 2000 (Oxiana Resources NL, 2002, p. 10).

In 2001, Eastern Mediterranean Minerals (Cyprus) Ltd. (EMM) [a joint venture of Oxiana Europe (60%) and Hellenic Mining (40%)] continued exploration for base metals associated with volcanogenic massive sulfide deposits in the Troodos Ophiolite Complex. EMM reprocessed geophysical data and drilled on the Klirou and Shia-Mathiatis prospects.

Lead.— After complaints about smoke and stench from the Nemitsas Foundry near Limassol, the Government had the foundry emissions, the residents of Omonia and Zakaki, and the area around the foundry tested for heavy-metal contaminants. The investigation revealed that the foundry conformed with European Union particulate matter emissions standards and that lead levels in local residents blood were "well below" accepted thresholds for blood-lead concentrations. The foundry was given until February 2002 (later extended to May) to resolve other pollution problems (Tukker and others, 2001, p. 19-20; Demetriou, 2001§; Matthew, 2002§).

Natural Gas and Petroleum.—In 2001, the Government held talks with Egypt and Syria about oil and natural gas exploration in the eastern Mediterranean Sea and construction of a $250 million natural gas pipeline to Cyprus from Syria (Alexander's Gas & Oil Connections, 2001§). The pipeline proposal meshed with Government plans to have the powerplants of the Electricity Authority of Cyprus switch to burning natural gas instead of residual fuel oil by 2006. The Turkish Cypriot administration also expressed interest in offshore hydrocarbon exploration.

References Cited

Oxiana Resources NL, 2002, Annual report: Melbourne, Australia, Oxiana Resources NL, 44 p.

Tukker, Arnold, Buikst, Harrie, van Oers, Lauran, and van der Voet, Ester, 2001, Risks to health and the environment related to the use of lead in products: Delft, Netherlands, Nederlandse Organisatie voor toegepast-natuurwetenschappelijk onderzoek, TNO Report STB-01-29, 102 p.

Internet References Cited

Alexander's Gas & Oil Connections, 2001, Cyprus, Syria and Egypt to decide on probing gas and oil reserves, accessed November 26, 2001, at URL http://www.gasandoil.com/goc/news/nte14725.htm.

Demetriou, Melina, 2001 (October 19), Nemitas report 'a whitewash,' accessed June 11, 2002, via URL http://www.cyprus-mail.com/October/19.

Matthew, Jennie, 2002 (January 22), Anger at new extension for Nemitsas foundry, accessed March 6, 2002, at URL http://www.cyprus-mail.com/January/22/news7.htm.

[1]Unless specifically stated, all data in this chapter are for the Republic of Cyprus in southern Cyprus because data related to the Turkish-controlled areas of northern Cyprus are sparse or unavailable.

[2]Where necessary, values have been converted from Cypriot pounds to U.S. dollars at the rate of Cy£0.6397=US$1.00.

[3]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

Republic of Cyprus Press and Information Office, 2001 (March 1), News item 02—Report on underground exploration of water and mineral resources in occupied Cyprus, accessed June 13, 2002, at URL http://www.hri.org/news/cyprus.tcpr/ 2001/01-03-27.tcpr.html.
Statistical Service of Cyprus, 2002a (May 5), Foreign trade, accessed June 11, 2002, at URL http://kypros.org/DSR/ key_figures/foreign_trade/ foreign_trade.htm.
Statistical Service of Cyprus, 2002b (April 12), National accounts, accessed June 11, 2002, at URL http://kypros.org/DSR/key_figures/national/ annual.htm.

Major Sources of Information

Mines Service
Ministry of Agriculture, Natural Resources and Environment
1422 Nicosia, Cyprus
Telephone: +357-2-309283
Fax: +357-2-316872
Statistical Service of Cyprus
13, Andreas Araouzos St.
1444 Nicosia, Cyprus
Telephone: +357-2-309305
Fax: +357 -2-374830
E-mail: cydsr@cytanet.com.cy

TABLE 1
CYPRUS: PRODUCTION OF MINERAL COMMODITIES 1/ 2/ 3/

(Thousand metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000	2001 p/
Cement, hydraulic		910	1,207	1,157	1,398	1,369
Clays:						
Bentonite	metric tons	98,700	121,850	138,853	167,500 r/	127
Other:						
For brick and tile manufacture		350 e/	380 e/	350	285 r/	300
For cement manufacture		340 e/	370 e/	360	450 r/	440
Total		690 e/	750 e/	710	735 r/	740
Copper, refined	metric tons	4,435	4,936	5,004	5,197	5,176
Gypsum, crude 4/	do.	234,300	296,800	181,546	260,000 r/	250,000
Lime, hydrated	do.	6,000 e/	5,500 e/	6,000	6,800	9,400
Petroleum refinery products:						
Liquefied petroleum gases	thousand 42-gallon barrels	367	344	393	345	359
Gasoline	do.	1,199	1,208	1,263	1,289	1,277
Kerosene and jet fuel	do.	195	212	238	285	288
Distillate fuel oil	do.	2,725 r/	2,849 r/	3,069 r/	3,027 r/	2,911
Residual fuel oil	do.	2,803 r/	2,929 r/	3,292 r/	3,274 r/	3,156
Asphalt and bitumen	do.	207	208	206	207	239
Other	do.	2	20	22	16	19
Total	do.	7,499 r/	7,770 r/	8,482 r/	8,443 r/	8,248
Stone, sand, gravel:						
Limestone, crushed (Havara) e/		2,000 r/	2,000 r/	2,000 r/	1,800 5/	1,500 5/
Marble		25	7	2	2	2
Marl, for cement production		1,500 e/	1,900 e/	1,600	1,800	1,780
Sand and gravel		6,990 r/	8,400 r/	8,500 r/	8,800 r/	9,300
Building stone		28	40	63	80 r/	55
Sulfur e/	metric tons	1,400	1,400	1,400	1,400	1,400
Umber	do.	7,120	6,056	9,169	7,500 r/	7,800

e/ Estimated. p/ Preliminary. r/ Revised.
1/ Table includes data available through July 8, 2002.
2/ Small quantities of the mineral pigments ocher and terra verte are mined intermittently. Mineral production data from the northern Turkish-occupied section of the country and production of secondary metals from scrap are not included in this table because available information is inadequate to make estimates of output.
3/ Sources of data include company annual reports, the Mines Service, and the Statistical Service of Cyprus. Estimated data are rounded to no more than three significant figures.
4/ About 4,000 metric tons per year of gypsum was calcined.
5/ Reported figure.
6/ Includes crushed aggregate.
7/ Includes crude, semifinished, and worked stone.

Digitized by Google

THE MINERAL INDUSTRY OF

IRAN

By Philip M. Mobbs

In 2001, Iran was the world's fourth largest producer of crude oil after Saudi Arabia, Russia, and the United States. Iranian oil production averaged about 3.74 million barrels per day (Mbbl/d) compared with a revised 3.70 Mbbl/d in 2000 and 3.56 Mbbl/d in 1999 (U.S. Energy Information Administration, 2002). Petroleum continued to provide the bulk of Iran's foreign exchange. In 2001, the gross domestic product (GDP) at current prices of this Middle Eastern country of about 66 million people was estimated to be almost $114 billion (International Monetary Fund, 2002b§[1]). The International Monetary Fund (2002a§) reported that real GDP increased by about 4.8% in 2001 and 5.7% in 2000.

Minerals have been mined in Iran for several thousand years. Although the focus of the mineral industry had shifted to the petroleum sector in the 1950s, the Government has recently encouraged investment in the exploitation of metals and industrial minerals to diversify the nation's economic dependence on oil and natural gas. Continued investment in the energy and transportation sectors will enhance Iran's ability to develop and market its mineral resources.

The U.S. Government's Iran and Libya Sanctions Act of 1996 (ILSA) (Public Law 104-172), which threatened to sanction any company (American or foreign) that exceeded a $20 million per year investment or trading limit with Iran in the petroleum sector initially hampered foreign investment in petroleum and other mineral industry projects in Iran. Despite the U.S. law, many European nations have not discouraged investment in Iran in recent years. There was some international expectation that the U.S. Government would allow the ILSA to expire in 2001; in August 2001, however, the U.S. Congress continued economic sanctions with the passage of Public Law 107-24 (the ILSA Extension Act of 2001), which extended the Iran and Libya Sanctions Act of 1996 through 2006 (Sipress and Behr, 2001).

In addition to ILSA, the Iranian Transactions Regulation, Title 31 Part 560 of the U.S. Code of Federal Regulations prohibited the exportation to Iran and importation from Iran of most goods and services. The prohibition of any involvement in the development of Iranian petroleum resources was specifically noted. American citizens and companies also were banned from investing or participating in Iran's mineral sector activities under Executive Orders 12957 of March 15, 1995, 12959 of May 6, 1995, and 13059 of August 19, 1997.

Structure of the Mineral Industry

The overall management of the minerals sector was under the auspices of the Ministry of Industry and Mines. The Ministry's authority covers all mining, smelting, and refining industries except the oil and gas segments, which were administered by the Ministry of Petroleum. Most of the country's active mines (estimated to be about 2,700) were privately owned, although the Government retained operational control of many of the larger companies in the minerals sector especially in the aluminum, ammonia, coal, copper, iron, salt, steel, and sulfur sectors. A tabulation of the structure of the mineral industry is available in the USGS Minerals Yearbook 2000.

Commodity Review

Metals

Aluminum.—In 2001, Technoexport Foreign Trade Co. Ltd. of the Czech Republic managed the continued construction of the 280,000-metric-ton-per-year-(t/yr)-capacity alumina refinery at Jajarm for the Iranian Aluminium Co. (IRALCO). Alumina production from imported bauxite was rescheduled to start in 2002. When initially considered in 1990, the plant had been scheduled for completion in 1995. A subsequent September 1999 startup date had been missed owing to technical problems that arose during construction. IRALCO expected to be processing local bauxite within a year after commercial operations begin (Metal Bulletin, 2002a). Alumina production from the Jarjarm plant will be shipped to domestic aluminum smelters in Arak and Bandar Abbas to reduce the smelters' dependence on imported alumina.

Copper.—Iran ranked 16th in the rank of the world's copper producers (Edelstein, 2003§). In order of capacity, the Sar Cheshmeh, the Meiduk, and the Songun Mines of Government's National Iranian Copper Industries Co. (NICICO) were the country's predominant copper ore producers. There was some private industry participation in the copper milling, scrap recycling, and wire drawing sectors.

In 2001, Zarcan Minerals Inc. (a subsidiary of Zarcan International Resources Inc. of Canada) filed applications for 15 exploration permits in the Sistan-va-Baluchestan Province. With the applications pending, Zarcan resumed exploration on the Chehel Kureh copper-gold-lead-zinc prospect, the Kuh-e Lar copper-gold prospect, and the Shurcha antimony-gold prospect.

Gold.—Much of the gold recovered in Iran was a byproduct of NICICO's Sar Cheshmeh copper complex operations. Additional gold was recovered from the Mouteh Mine and from gold placer mines in the Neyshabour area.

Pouya Zarcan Agh Darreh Co. (PZA), which was Zarcan's joint venture with IRAMCO Aluminum Raw Material Co., continued to explore the Agh Darreh gold prospect in

[1]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

northwestern Iran. In 2001, Zarcan reported measured resources at Agh Darreh of 420,000 metric tons (t) at a grade of 5.7 grams per metric ton (g/t) gold and indicated resources of 3.04 million metric tons (Mt) at a grade of 3.7 g/t gold (Zarcan International Resources Inc., 2001). In 2001, PZA completed an environmental assessment study for a carbon-in-leach mill on the property and applied for environmental permits for the gold mill and tailings dam.

Iron and Steel.—In recent years, Iranian crude steel production has ranged between 5 million and nearly 7million metric tons per year (Mt/yr). In 2001, Iran's steel production of almost 6.9 Mt placed the nation 22d on the list of world producers (table 11; Fenton, 2002§).

During the past 4 years, the United States has been a significant market for the world's excess steel. Because the American embargo eliminated Iranian access to the U.S. market, Iranian steel production that exceeded domestic requirements was exported to Europe and the Middle East. Iranian steel exports to Europe, however, attracted the attention of the European Confederation of Iron and Steel Industries which considered antidumping action against Iranian steel. Simultaneously, the Iranian steel industry contended with increased imports of steel from Kazakhstan, Russia, and the Ukraine (Metal Bulletin, 2002b). Despite the availability of surplus steel, Iranian steel production was projected to more than double to 14.7 Mt/yr by 2006 (Iran Daily, 2001a§). In 2001, there were numerous steel projects at various stages of planning or construction; these included the expansion of Isfahan Steel Co.'s plant with the addition of a 150-t electric-arc furnace and a third blast furnace (1.4-Mt/yr capacity), the continued expansion of hot-rolled coil capacity to 4 Mt/yr from 3.1 Mt/yr at the Mobarakeh Steel plant, and the construction of a 100,000-t/yr angles mill at Arak. Additional proposed facilities included a 4-Mt/yr iron ore pellet plant at Sirjan, a 1.65-Mt/yr direct reduction iron plant at Bandar Abbas, a 1.5-Mt/yr steel slab mill at Bandar Abbas, a 300,000-t/yr steel bar mill at Isfahan, and a 120,000-t/yr light section steel mill at Isfahan (Metal Bulletin, 2000, 2001a-c; Middle East Economic Digest, 2001d; Iran Daily, 2001c§).

Lead and Zinc.—Iran was a minor lead and zinc producer. Lead production accounted for about 0.5% of the world's lead and ranked Iran as the 20th leading lead-producing nation (Smith, 2002§). As the world's 18th leading zinc producer, Iran produced about 1% of the world's zinc (Plachy, 2002§). Most of the nation's lead and zinc production was derived from the Angouran, Emarat, Irankouh, and Kushk Mines. Because of the number of zinc smelters that had come online during the past few years, exports of zinc concentrate to Turkey had been significantly reduced.

In 2001, state-owned General Iranian Mining Co.'s 50% equity interest in a joint venture with Union Capital Ltd. of Australia (30%) and Itok GmbH of Austria (20%) was transferred to the Iranian Mining and Industries Development and Renovation Organisation (an affiliate organization of the Ministry of Industry and Mines). The joint venture completed a prefeasibility study of the proposed development of the Mehdiabad zinc project as an open pit mine, applied for an exploitation license, and proposed to complete a $4 million bankable feasibility study 18 months after receiving the exploitation license. Union Capital reported that indicated and inferred resources of the deposit were 217.9 Mt of ore at a grade of 7.20% zinc, 2.34% lead, and 51 g/t silver using a 4% zinc cutoff grade (Union Zinc Ltd., 2001§; Union Capital Ltd., 2002§).

Industrial Minerals

There are numerous industrial mineral deposits in Iran. Minerals and mineral products produced included asbestos, alum, ammonia, barite, bentonite, boron, celestite, cement, other clays, diatomite, dolomite, feldspar, fluorspar, granite, gypsum, kaolin, lime, limestone, magnesite, marble, mica, ochre, perlite, pumice, salt, construction sand, glass sand, sodium sulfate, crushed stone, sulfur, talc, travertine, turquoise, and urea.

Feldspar and Glass.—New feldspar deposits were reported in Isfahan Province and the Lake Urourmeiyeh region (Industrial Minerals, 2001; H. Emami, written commun., November 21, 2002). A 180,000-t/yr-capacity float glass plant was proposed for Qazvin by the joint venture of Qazvin Glass Co. of Iran and Pilkington plc of the United Kingdom (Middle East Economic Digest, 2001f).

Fertilizer.—In 2001, National Petrochemical Co. awarded construction contracts for a 660,000-t/yr granulated urea plant in the Razi Petrochemical Economic Zone at Bandar Iman Khomeini and for a fertilizer facility with production capacities of about 750,000 t/yr of ammonia and about 1.2 Mt/yr of urea in the Bandar Assaluyeh Special Economic/Energy Zone (Middle East Economic Digest, 2001c, h). The Bandar Assaluyeh plant would use gas from the offshore South Pars Field. In a joint venture with Indian Farmers Fertilizer Cooperative Ltd. of India and the Indian Government's Krishak Bharati Cooperative Ltd., the Qeshm Free Area Authority proposed to build an ammonia plant in the Qeshm Free Area.

Stone.—Dimension stone quarries in Iran produced a wide variety of color and patterns of granite, marble, and travertine. Stone quarries accounted for about 20% of the mining and quarry operations active in Iran. Iran was strategically located to supply the demand for dimension stone of the construction industries of the Gulf States.

Mineral Fuels

Natural Gas.—The South Pars natural gas refinery at Bandar Assaluyeh in Bushehr Province was under construction in 2001. The gas plant was designed to recover 40,000 barrels per day of liquids and 200 metric tons per day of sulfur from a throughput of 56 million cubic meters per day of natural gas (Arab Petroleum Research Center, 2002, p. 147; Iran Daily, 2001e§). Other proposed natural gas plants included a 40-million-cubic-meter-per-day facility at Bidboland and the 10,000-cubic-meter-per-day plant at Ilam (Iran Daily, 2001d§).

Construction continued on the third transcountry gas pipeline, the 142-centimeter-diameter 85-million-cubic-meter-

Digitized by Google

per-day-capacity Iran Gas Trunkline 3 (IGAT-3), which will connect the South Pars gas facilities at Bandar Assaluyeh to distribution facilities in northwest Iran (Arab Petroleum Research Center, 2002, p. 149; Middle East Economic Digest, 2001a). Studies of the proposed 110-million-cubic-meter-per-day Iran Gas Trunkline 4 and a pipeline to Armenia were reportedly undertaken (Middle East Economic Digest, 2001e; Scientific Surveys Ltd., 2001, p. 5). Various options to ship natural gas to India from Bandar Assaluyeh were under consideration; these included a deepwater offshore gas pipeline to Veraval, India; a shallow water offshore gas pipeline to Okha, India; an overland gas pipeline, which would cross through Pakistan and then would connect to an existing natural gas pipeline near Nagda, India; and a liquified natural gas facility (Middle East Economic Digest, 2001b, g).

The 14-billion-cubic-meter-per-year-capacity gas export pipeline to Turkey was completed at yearend. Exports to Turkey were to begin in 2002. In addition to gas exports, Iran imported natural gas from Turkmenistan.

Petroleum.—In 2001, Iran proposed to increase its crude oil production capacity, as did many oil-producing countries. The planned national crude oil production capacity increase to 2,900 million barrels (Mbbl) by 2005 from about 1,400 Mbbl was estimated to require an additional $40 billion in foreign investment. Any increase would be subject to the production quotas of the Organization of the Petroleum Exporting Countries (Iran Daily, 2001b§).

In the crude oil refining sector, contracts to upgrade the refineries in Tabriz and Tehran were awarded to China Petroleum and Chemical Corp. (Sinopec) and permits were issued to build a new refinery in Ardebil Province. Sinopec also was contracted to build crude oil terminal facilities at the port of Neka, Iran, which would facilitate the Iranian Ministry's crude oil swap program in which crude oil from the inland nations surrounding the Caspian Sea would be delivered to Neka for use in northern Iran and swapped for equivalent amounts of Iranian crude, which would be delivered to terminals in the Persian Gulf for export.

More-extensive coverage of the natural gas and petroleum industry of Iran is available from the U.S. Energy Information Administration (2002§).

Infrastructure

Transportation improvements continued to be made throughout the country. Iran's network of 140,200 kilometers (km) of highway, 5,900 km of crude oil pipeline, 4,550 km of natural gas pipeline, 3,900 km of petroleum product pipeline, 6,130 km of rail, and an extensive port system on the Caspian Sea, Gulf of Oman, and Persian Gulf facilitated transport of minerals and mineral products with neighboring countries (Afghanistan, Armenia, Azerbaijan, Pakistan, Turkmenistan, and Turkey) and the rest of the world (U.S. Central Intelligence Agency, 2002§).

References Cited

Arab Petroleum Research Center, 2002, Iran: Arab Oil & Gas Directory—2002, p. 117-158.

Industrial Minerals, 2001, Mineral notes—Iranian feldspar find: Industrial Minerals, no. 401, February, p. 73.

Metal Bulletin, 2000, Nisco outlines steel plant expansions: Metal Bulletin, no. 8528, November 23, p. 19.

Metal Bulletin, 2001a, Iran plans big capacity increase at Mobarakeh: Metal Bulletin, no. 8565, April 9, p. 17.

Metal Bulletin, 2001b, Iranian tubemaker adds meltshop and two mills: Metal Bulletin, no. 8507, August 6, p. 13.

Metal Bulletin, 2001c, National Iranian Steel Co invites bids for Hormozgan contract: Metal Bulletin, no. 8601, August 20, p. 13.

Metal Bulletin, 2002a, Iranian alumina project to start in 2002: Metal Bulletin, no. 8644, January 28, p. 4.

Metal Bulletin, 2002b, Mobarekeh wants more import controls: Metal Bulletin, no. 8641, January 17, p. 14.

Middle East Economic Digest, 2001a, Bids for 12 pumping stations for new gas trunkline: Middle East Economic Digest, v. 45, no. 3, January 19, p. 9.

Middle East Economic Digest, 2001b, India-Iran gas pipeline under review: Middle East Economic Digest, v. 45, no. 28, July 13, p. 11.

Middle East Economic Digest, 2001c, Japanese team wins fertilizer project: Middle East Economic Digest, v. 45, no. 22, June 1, p. 14.

Middle East Economic Digest, 2001d, New steel project announced: Middle East Economic Digest, v. 45, no. 32, August 10, p. 12.

Middle East Economic Digest, 2001e, News in brief—Iran: Middle East Economic Digest, v. 45, no. 19, January 19, p. 16.

Middle East Economic Digest, 2001f, Pilkington moves into Iranian glass market: Middle East Economic Digest, v. 45, no. 13, March 30, p. 12.

Middle East Economic Digest, 2001g, Saipem offers cheaper gas line to India—Steps in with deep sea gas line proposal: Middle East Economic Digest, v. 45, no. 11, March 16, p. 12.

Middle East Economic Digest, 2001h, NPC awards urea and LAB projects: Middle East Economic Digest, v. 45, no. 8, February 23, p. 10.

Scientific Surveys Ltd., 2001, Iran—Studies start for IGAT-4: Pipeline Report, October, 16 p.

Sipress, Alan, and Behr, Peter, 2001, Bush says Iran, Libya sanctions to stay: Washington Post, April 20, p. A20.

U.S. Energy Information Administration, 2002, Table 11—World oil production, *in* Monthly energy review: Washington, DC, U.S. Energy Information Administration, August, p. 146-147.

Zarcan International Resources Inc., 2001, Significant resource update for Iranian gold project: Vancouver, British Columbia, Canada, Zarcan International Resources Inc. press release, June 13, 2 p.

Internet References Cited

Edelstein, D.L., 2003, Copper, Minerals Yearbook 2001, accessed March 10, 2003, at URL http://minerals.usgs.gov/minerals/pubs/commodity/copper/coppmyb01.pdf.

Fenton, M.D., 2002, Iron and Steel, Minerals Yearbook 2001, accessed January 22, 2003, at URL http://minerals.usgs.gov/minerals/pubs/commodity/iron_&_steel/festmyb01.pdf.

International Monetary Fund, 2002a (September), Gross domestic product, current prices—All countries, accessed October 28, 2002, at URL http://www.imf.org/external/pubs/ft/weo/2002/02/data/index.htm.

International Monetary Fund, 2002b (September), Real gross domestic product (annual percent change)—All countries, accessed October 28, 2002, at URL http://www.imf.org/external/pubs/ft/weo/2002/02/data/index.htm.

Iran Daily, 2001a (February 11), Increase in steel, iron output planned, accessed February 13, 2001, via URL http://www.iran-daily.com/2.

Iran Daily, 2001b (April 14), Iran seeks $40B to raise crude output, accessed April 20, 2001, via URL http://www.iran-daily.com/6.

Iran Daily, 2001c (March 15), Mobarakeh Steel complex finalizes buyback deal, accessed March 20, 2001, via URL http://www.iran-daily.com/2.

Iran Daily, 2001d (April 22), NIGC plans 3 refineries, accessed April 30, 2001, via URL http://www.iran-daily.com/7.

Digitized by Google

Iran Daily, 2001e (May 5), South Pars refinery registers 35% progress, accessed May 11, 2001, via URL http://www.iran-daily.com/5.
Plachy, Jozef, 2002, Zinc, Minerals Yearbook 2001, accessed January 22, 2003, at URL http://minerals.usgs.gov/minerals/pubs/commodity/zinc/zincmyb01.pdf.
Smith, G.R., 2002, Lead, Minerals Yearbook 2001, accessed January 22, 2003, at URL http://minerals.usgs.gov/minerals/pubs/commodity/lead/leadmyb01.pdf.
Union Capital Ltd., 2002, Mehdiabad zinc/lead/silver project, accessed November 21, 2002, at URL http://www.unionmining.com.au/companyprojects/mehdiabad.htm.
Union Zinc Ltd., 2001, About the project, accessed December 26, 2001, at URL http://www.unionzinc.com.au/_html/project/project.html.
U.S. Central Intelligence Agency, 2002 (January 1), Iran, World Factbook, accessed January 22, 2003, at URL http://www.odci.gov/cia/publications/factbook/geos/ir.html.
U.S. Energy Information Administration, 2002 (May), Iran, Country Analysis Brief, accessed September 5, 2001, at URL http://www.eia.doe.gov/emeu/cabs/iran.html.

Major Sources of Information

Geological Survey of Iran
P.O. Box 13185-1491
Tehran, Iran
Ministry of Industry and Mines
P.O. Box 1416
No. 248 Somayyeh Ave.
14155 Tehran, Iran
Telephone: +(98) 21-836050
Ministry of Petroleum
P.O. Box 1863
Tehran, Iran
Telephone: +(98) 21-6466563
Fax: +(98) 21-6465922

TABLE 1
IRAN: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/		1997 e/	1998	1999	2000 e/	2001 e/
METALS						
Aluminum:						
Bauxite, gross weight		150,000	336,000	912,451	400,000	400,000
Metal, primary ingot		92,300	123,759	137,421	140,000	140,000
Arsenic, orpiment and realgar, concentrates e/		492	323	300	400	400
Chromite, mine output, concentrate 4/						
Gross weight		168,984 5/	211,555 r/	254,685 r/	153,000 r/	104,900
Cr_2O_3 content e/		82,800	104,000 r/	125,000 r/	75,000 r/	51,500
Copper:						
Mine output:						
Ore mined (1% to 1.2% Cu):						
Gross weight	thousand tons	14,200	13,740	13,770	13,800	14,400
Cu content e/		117,000	137,000	138,000	138,000	144,000
Concentrate (29% to 35% Cu):						
Gross weight		320,000	378,504	381,346	350,000	390,000
Cu content		108,000	128,300	131,000	125,000 r/	133,000
Metal:						
Smelter output, blister/anode		99,000	150,000	154,000	154,000	154,000
Refined output, cathode		103,300	129,000	131,700	132,000	132,000
Gold, mine output, Au content 6/	kilograms	684 5/	856	930	765 r/	770
Iron and steel:						
Ore and concentrate:						
Gross weight	thousand tons	12,750 5/	10,536	10,776	12,370 r/ 5/	12,100
Fe content e/	do.	6,300	5,200	5,300	5,500 r/	5,900
Metal:						
Pig iron	do.	2,053 5/	2,087	2,147	2,200	2,300
Direct-reduced iron	do.	4,380 5/	3,690	4,120	4,740	5,000
Ferrochromium		11,450 5/	13,745	13,680	11,505 r/ 5/	8,430
Ferrosilicon e/		40,000	40,000	46,000	40,000	40,000
Steel, crude, ingots and castings	thousand tons	6,322 5/	5,608	6,277	6,600	6,890
Lead:						
Mine output, concentrate:						
Gross weight e/		37,000	21,216 5/	22,000	27,000	27,000
Pb content		18,200	11,000	11,000 e/	15,000	15,000
Refinery output, includes secondary		49,400	47,000	50,000 r/ e/	53,000 r/ e/	50,000
Manganese, mine output, (30% to 35% Mn):						
Gross weight		135,000	101,390	104,096	105,000	100,000
Mn content e/		40,000	30,500	32,000	32,000	30,000
Molybdenum, mine output, concentrate (56% Mo): e/						
Gross weight		1,800	4,350 5/	4,906 5/	4,900	5,100
Mo content		600	1,400	1,600	1,600	1,700
Silver, mine output, Ag content		30	19	21	22	22

See footnotes at end of table.

Digitized by Google

TABLE 1--Continued
IRAN: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/		1997 e/	1998	1999	2000 e/	2001 e/
METALS--Continued						
Zinc: e/						
Mine output, concentrate:						
Gross weight		132,000	160,000	160,000	182,000 5/	240,000 5/
Zn content		76,500	80,000	80,000	90,000	120,000
Metal		12,000 r/ 5/	23,000	31,000 r/ 5/	49,000 r/ 5/	73,000 5/
INDUSTRIAL MINERALS						
Asbestos: e/						
Concentrate, (3% to 8% marketable fiber)		86,200	45,000	40,000	40,000	40,000
Marketable fiber		4,300	2,258 5/	2,000	2,000	2,000
Barite		181,174 5/	187,677	183,850	185,000	218,000
Boron, borax		420	2,086	3,663	3,700	3,800
Cement, hydraulic	thousand tons	19,300	21,300 r/ e/	22,080	23,880 5/	24,000
Clays:						
Bentonite		105,300 5/	83,279	64,957	70,000	80,000
Industrial clays e/		350,000	450,000	400,000	450,000	450,000
Kaolin		478,964 5/	582,485	837,277	850,000 r/	800,000
Diatomite e/		90	600	4,350	4,500	4,500
Feldspar		125,000 5/	185,709	239,779	200,000 r/	200,000
Fluorspar		24,846 5/	25,904	18,387	20,000	20,000
Gemstones, turquoise	kilograms	14,000 5/	6,000	20,000	20,000	20,000
Gypsum	thousand tons	9,966 5/	11,843	10,834	11,000	11,000
Industrial or glass sand (quartzite and silica) e/		1,000,000	1,000,000	1,000,000	1,000,000	1,700,000
Lime	thousand tons	2,500 e/	2,737	2,138	2,200	22,000
Magnesite		119,000 5/	109,597	141,081	141,000	143,000
Mica		1,086 5/	1,084	1,425	2,000	2,000
Nitrogen:						
N content of ammonia		879,800 5/	1,034,000	865,000	965,000 5/	1,087,000
N content of urea		610,500 5/	744,000 r/	606,000 r/	624,000 r/	651,000
Perlite		10,000 e/	13,320	15,069	15,000	15,000
Pigments, mineral, natural iron oxide, ochre e/		10,000	13,300	13,300	13,500	13,000
Pumice and related volcanic materials e/		200,000	150,000	150,000	150,000	700,000
Salt		1,180,000	1,911,800	1,600,000	1,600,000	2,000,000
Sodium compound, caustic soda e/		15,000	20,000	20,000	20,000	20,000
Stone: e/						
Construction and building, crushed	thousand tons	14,828 5/	11,670 5/	11,000	12,000	12,000
Dimension and decorative:						
Granite	do.	195 5/	181 5/	195 5/	200	200
Marble:						
Blocks	do.	4,500	6,000	6,400	7,000	6,600
Crushed	do.	450	500	500	550	500
Slabs	do.	50	100	100	110	100
Travertine:						
Blocks	do.	550	516 5/	435 5/	500	400
Crushed and slabs	do.	70	100	65	100	100
Total	do.	5,820 r/	7,400	7,700	8,500	7,900
Dolomite	do.	267 5/	475	286	300	300
Limestone	do.	33,000	33,000	33,000	35,000	40,000
Strontium, celesite e/		2,000	2,000	1,650 5/	2,000	2,000
Sulfates, natural: e/						
Aluminum potassium sulfate (alum)		12,000	12,000	12,000	12,000	10,000
Sodium sulfate		480,000	264,973	308,093	300,000	300,000
Sulfur: e/						
Byproduct of petroleum and natural gas		850,000	889,000 r/	963,000 r/	963,000 r/	933,000
Byproduct of metallurgical processing, S content of acid		50,000	50,000	47,000 r/	50,000	50,000
Total		900,000	939,000 r/	1,010,000 r/	1,010,000 r/	983,000
Talc		29,660 5/	27,038	25,000 e/	25,000	25,000
MINERAL FUELS AND RELATED MATERIALS						
Coal	thousand tons	1,750	1,711	1,507	1,815 r/ 5/	2,000
Coke	do.	800	22,000	20,000 e/	25,000	25,000
Gas, natural:						
Gross	million cubic meters	82,600	89,000	90,600 e/	120,000	120,000
Dry	do.	47,000	50,000	51,000 e/	57,800 r/	65,000

See footnotes at end of table.

Digitized by Google

TABLE 1--Continued
IRAN: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/		1997 e/	1998	1999	2000 e/	2001 e/
MINERAL FUELS AND RELATED MATERIALS--Continued						
Natural gas plant liquids e/	thousand 42-gallon barrels	22,000	23,000	24,000	25,000	25,000
Petroleum:						
Crude	do.	1,337,360 5/	1,325,000	1,300,000 e/	1,360,000	1,350,000
Refinery products: e/						
Liquefied petroleum gases	do.	14,500	15,700	15,000	16,000	16,000
Motor gasoline	do.	54,500	65,700	60,000	65,000	65,000
Jet fuel	do.	10,000	13,000	11,000	12,000	12,000
Kerosene	do.	36,000	40,000	36,000	40,000	40,000
Distillate fuel oil	do.	109,000	136,000	120,000	140,000	140,000
Residual fuel oil	do.	98,000	163,000	140,000	160,000	160,000
Other	do.	64,000	61,000	60,000	67,000	67,000
Total	do.	386,000	494,000	442,000	500,000	500,000

e/ Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. r/ Revised.
1/ Table includes data available through November 25, 2002.
2/ Data are for Iranian years ending March 21 of that stated, except data for natural gas, plant liquids, and petroleum, which are for Gregorian calendar years.
3/ In addition to commodities listed, the following may have been produced, but information is inadequte to estimate output: ferromanganese, ferromolybdenum, nepheline syenite, phosphate rock, selenium, shell, silicomanganese, vermiculite, and zeolite.
4/ Chromite content of concentrate estimated to be 48% to 50% Cr_2O_3 for 1997 and 42% to 45% Cr_2O_3 for 1998 and 1999.
5/ Reported figure.
6/ Includes gold recovered from the Mouteh gold mine and from the Sarcheshmeh copper complex.

TABLE 2
IRAN: STRUCTURE OF THE ZINC INDUSTRY IN 2001

(Thousand metric tons unless otherwise specified)

Process stage	Major operating companies (and major equity owners)	Location of facilities	Annual capacity
Ore	Iran Zinc Mine Development Co.	Angouran Mine, Zanjan Province	500 1/
Do.	BAMA Co.	Irankouh (Goushfil, Tapeh Sorhk, and Kolah Darvazeh pits) Mine, Esfahan Province	290 1/
Do.	National Iranian Lead & Zinc Co.	Kushk Mine, Yazd Province	175 1/
Do.	Shahin Mining and Industrial Co.	Emarat Mine, Markazy Province	NA
Do.	Bafgh Mining Co.	NA	25
Do.	Sormak Mining Co.	Ahangaran Mine, Zanjan Province	5 1/
Do.	Calcimine Co.	Alam Candy Mine	NA
Concentrate	do.	NA	100
Do.	Iran Zinc Mine Development Co.	Dandi Calcination plant, Zanjan Province	50
Do.	Bafgh Mining Co.	NA	25
Do.	Iran Zinc Mine Development Co.	NA	20
Do.	Shahin Mining and Industrial Co.	NA	10
Do.	Mineral Processing Co. of Iran	NA	NA
Do.	Calcimine Co.	Khoramshar plant	4 2/
Metal	Bafgh Zinc Smelting Co.	Bafgh, Yazd Province	28
Do.	Angoran Zinc Melting Co. (Calcimine Co.)	Smelter at Angouran Mine, Zanjan Province	12
Do.	Faravari Mavad Madani Iran	Zanjan Province	10
Do.	Bandar Abbas Zinc Smelting Co.	Hormozgan Province	12
Do.	Qeshm Zinc Melting Co. (Calcimine Co.)	Qeshm Island, Hormozgan Province	5
Do.	Isfahan Zinc Smelting Co.	Isfahan Province	5
Do.	Zarin Rooy	Zanjan Province	3
Do.	Kavosh Kar Madan	Tehran Province	3
Do.	Iran Rooy Gostar	Zanjan Province	3
Do.	Rooy Sazan	do.	2
Do.	Negin Rooy	Semnan Province	2
Do.	Other producers	Various locations	14

NA Not available.
1/ Includes lead and zinc ores.
2/ Closed.

Digitized by Google

THE MINERAL INDUSTRY OF

IRAQ

By Philip M. Mobbs

The mineral industry of Iraq was dominated by the production of hydrocarbons. In 2001, when the price of petroleum dropped on world markets, Iraq's gross domestic product (GDP) was estimated to have fallen to about $29.7 billion compared with $31.8 billion in 2000 (Australian Department of Foreign Affairs and Trade, 2001§[1]). The value of petroleum exports accounted for about 50% of GDP.

The mineral industry was administered by the Ministry of Industry and Mineral Resources and the Ministry of Oil. Legislation that controlled mining included Law 8 of 1997 and Statutory Instructions 1 of October 11, 1999, which included mining regulations. Petroleum legislation included Law 229 of December 14, 1970, Law 8 of 1997, and Resolution 1400 of September 1, 1980. Soon after Iraq's invasion of Kuwait in 1990, United Nations (U.N.) Security Council Resolution 661 restricted international trade with Iraq. Official Iraqi crude oil exports had resumed in 1996 under U.N. Security Council Resolution 986 (known as the Oil for Humanitarian Aid Agreement, or the Oil for Food Program), although unofficial export routes also were used to evade the trade embargo on Iraqi crude oil and petroleum products (Middle East Economic Digest, 2001; Hoyos, 2002). In 2001, the Oil for Food Program was modified and renewed by Security Council Resolutions 1352, 1360, and 1382.

Iraq produced crude oil and natural gas from a few oilfields (tables 1, 2). Estimates of average crude oil production in 2001 ranged from about 2.355 million to 2.45 million barrels per day (Mbbl/d) (Oil & Gas Journal, 2002; U.S. Energy Information Administration, 2002§). In 2001, the Government reported several successful oil and natural gas exploration wells in the Western Desert and announced that proven oil reserves had been increased to about 115 billion barrels and that natural gas reserves exceeded 3.2 trillion cubic meters (Organization of the Petroleum Exporting Countries, 2001; Schlumberger realtimenews, 2002§). Other mineral production was limited. In 2001, the State Organization for Minerals reported the discovery of a sulfur deposit in the Western Desert near Akashat (Iraq Press, 2001§).

The Government proposed a multibillion dollar bridge, hospital, housing, road, and school rebuilding program and projected a significant demand for imported and local construction materials in the near future (International Fairs & Promotions s.a.r.l., undated). Several small [10,000-barrel-per-day (bbl/d)-capacity] crude oil refineries were under construction (Iran Daily, 2000§).

Official exports of Iraqi crude oil were transported by pipeline to the the port of Mina al-Bakr, Iraq, and the Ceyhan oil terminal in Turkey. Iraq shipped about 90,000 bbl/d of crude oil and products to Jordan by truck under U.N. approval. About 100,000 to 200,000 bbl/d of crude oil was piped to Syria, and between 80,000 and 200,000 bbl/d of crude oil and petroleum products reportedly was smuggled out of Iraq by boat or truck (Middle East Economic Digest, 2001; Sipress, 2001; Hoyos, 2002). In 2001, an average of 778,000 bbl/d of exported Iraqi crude oil reached the United States. This accounted for about 8.5% of net U.S. crude oil imports. The United States imported an average 620,000 bbl/d from Iraq in 2000, 725,000 bbl/d in 1999, 336,000 bbl/d in 1998, and 89,000 bbl/d in 1997. Iraq was the United States' sixth largest crude oil supplier (U.S. Energy Information Administration, 2002).

In 2001, the Government promoted the development of its natural gas resources. There were nearly 60 undeveloped evaluated petroleum prospects in addition to large unexplored areas. A number of international oil companies had entered into buy-back (post-1999) or production-sharing (pre-2000) contracts, which were suspended because of the U.N. sanctions; the Government, however, was becoming impatient with the delay in exploration and development (Iran Daily, 2001§). The Government projected that it would take 6 to 8 years after the U.N. embargo is lifted to reach a target production capacity of 6 Mbbl/d and 10 years to attain an average natural gas production of 140 billion cubic meters per year (Oil & Gas Journal, 2000; Middle East News Online, 2001§). Actual production could be subject to quotas allocated by the Organization of the Petroleum Exporting Countries, given the impact that increased production would have on oil prices received by other members of the cartel.

More extensive coverage of the Iraqi petroleum sector is available in the U.S. Energy Information Administration's Iraq Country Analysis Brief (U.S. Energy Information Administration, 2002§).

References Cited

Hoyos, Carlos, 2002, Oil smugglers keep money flowing back into Saddam's Iraq: Financial Times, January 17, p. 3.

International Fairs & Promotions s.a.r.l., [undated], Project Iraq 2002: Beirut, Lebanon, International Fairs & Promotions s.a.r.l, 8 p.

Middle East Economic Digest, 2001, Iraq seeks to torpedo new sanctions resolution: Middle East Economic Digest, v. 45, no. 22, June 1, p. 11.

Oil & Gas Journal, 2000, The opening of Iraq—Post-sanctions Iraqi oil—Its effects on world oil prices: Oil & Gas Journal, v. 98, no. 3, February 14, p. 41-43.

Oil & Gas Journal, 2002, Statistics—Worldwide crude oil and gas production: Oil & Gas Journal, v. 100, no. 10, March 11, p. 86.

Organization of the Petroleum Exporting Countries, 2001, Iraq discovers new oil and gas areas in the western desert: OPEC Bulletin, v. 32, no. 6, p. 20.

[1]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

Sipress, Alan, 2001, More Iraqi oil evading sanctions: Washington Post, February 18, p. A1, A33.
U.S. Energy Information Administration, 2002, Tables 3.3a to 3.3h—Petroleum imports from various countries: Monthly Energy Review, April, p. 48-55.

Internet References Cited

Australian Department of Foreign Affairs and Trade, 2001 (September), Iraq, Fact sheet, accessed June 7, 2002, at URL http://www.dfat.gov.au/geo/fs/iraq.pdf.
Iran Daily, 2000 (July 3), Economic features—Iraq plans six oil installations, accessed July 3, 2000, at URL http://www.iran-daily.com/daily.shtml.
Iran Daily, 2001 (February 26), Iraq warns Lukoil, Middle East News Online, accessed March 4, 2001, at URL http://www.iran-daily.com/5.
Iraq Press [London, United Kingdom], 2001 (May 25), Fresh sulfur deposits found in Western Desert, Middle East News Online, accessed May 29, 2001, at URL http://www.middleeastwire.com/iraq/business/stories/200110525_meno.shtml.
Middle East News Online, 2001 (May 20), Iraq luring foreign firms to invest in gas riches, Middle East News Online, accessed May 29, 2001, at URL http://www.middleeastwire.com/iraq/business/stories/200110520_2_meno.shtml.
Schlumberger realtimenews, 2002 (May 26), Business and finance—Indian, Indonesian firms in Iraq gas search, accessed May 27, 2002, at URL http://www.slb.com/print_story.cfm?storyid=568838&printable=1.
U.S. Energy Information Administration, 2002 (March), Iraq, Country Analysis Brief, accessed May 27, 2002, at URL http://www.eia.doe.gov/emeu/cabs/iraq2.html.

TABLE 1
IRAQ: ESTIMATED PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Thousand metric tons unless otherwise specified)

Commodity 3/		1997	1998	1999	2000	2001
METALS						
Steel, crude		200	200	200	50 r/	50
INDUSTRIAL MINERALS						
Cement, hydraulic		1,700	2,000	2,000	2,000	2,000
Nitrogen, N content of ammonia		220	220	220	200 r/	200
Phosphate rock, beneficiated, phosphorus pentoxide content		300	300	300	200 r/	100
Salt		250	250	300	300	300
Sulfur, elemental:						
Native, Frasch		98 r/	98 r/	98 r/	98 r/	98
Byproduct 4/		2 r/	2 r/	2 r/	2 r/	2
Total		100 r/	100 r/	100 r/	100 r/	100
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	3,800	6,000	7,000	7,500	7,000
Dry	do.	3,000	3,000	2,800	3,000	2,920
Natural gas plant liquids	thousand 42-gallon barrels	10,000	8,000	3,000	4,000	4,000
Petroleum:						
Crude (including lease condensate)	do.	433,000 5/	750,000 5/	915,000 5/	937,000 r/	860,000
Refinery products	do.	175,000	180,000	125,000	140,000	170,000

r/ Revised.
1/ Includes data available through May 23, 2002.
2/ Estimated data are rounded to no more than three significant digits.
3/ In addition to commodities listed, the following also were probably produced: secondary aluminum, clay, fertilizers, gypsum, secondary lead, lime, limestone, industrial (glass or silica) sand, sand and gravel, and stone, but information is inadequate to estimate output.
4/ Presumably from petroleum and natural gas processing.
5/ Reported figure.

Digitized by Google

TABLE 2
IRAQ: STRUCTURE OF THE MINERAL INDUSTRY IN 2001

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum		Ur State Establishment (Government)	Aluminum remelt facility at Al Nassiriya	NA
Cement		Iraqi Cement State Enterprise (Government)	Al Qaim, Baghdad, Fallujah II (white cement), Hindiyah Barrage, Kerbala, Kubaisa, and Kufa I and II plants	NA
Do.		Sarchinar State Cement Enterprise (Government)	Sarchinar plant, Sulaymaniyah	NA
Do.		Southern Cement Enterprise (Government)	Samawah I and II plants, Samawah	NA
Do.		State Establishment for Building Materials - Mosul (Government)	Al Tamin, Badoosh II and III, Hammam al'Alil I and II, Sinjar, and Tasluja plants	NA
Fertilizers		General Fertlizers Industries Co. (Government)	Ammonia plant at Basra	300,000
Do.		do.	Urea plant at Basra	400,000
Do.		do.	Nitrogenous fertilizer plant at Khor al Zubair	NA
Do.		State Enterprise for Phosphates (Government)	Phosphatic fertilizer plant at Al-Qaim	130,000
Iron		State Enterprise for Iron and Steel Industries (Government)	Midrex direct reduced iron plant at Khor al Zubair	(1/)
Lead		N/A	Secondary lead smelter at Fallujah	NA
Natural gas 2/	thousand cubic meters	North Oil Company (Government)	Al-Anfal Field	5,700
Petroleum, crude		do.	Ain Zalah, Avanah, Bai Hassan, Butmah, East Baghdad, Jambur, Khabbaz, Kirkuk, Ninava, Saddam, and Sufaiya Fields	(3/)
Do.		do.	Khurmala Dome	(4/)
Do.		South Oil Company (Government)	Bin Umr, Luhais, Missan, West Qurna, North Rumaila, South Rumaila, and Zubair Fields	(3/)
Petroleum products	barrels per day	Midland Refineries Company (Government)	Daura refinery at Daura	100,000
Do.	do.	do.	Al Wassat refinery at Babil 5/	10,000
Do.	do.	North Refineries Company (Government)	Baiji (North and Salaheddin) refineries at Baiji	300,000
Do.	do.	do.	New refinery at Baiji 5/	10,000
Do.	do.	South Refineries Company (Government)	Basra refinery at Basra	170,000
Do.	do.	do.	Meisan Refinery at Ammarah	10,000
Do.	do.	N/A (Government)	Refinery near Ash Sharqat	NA
Do.	do.	N/A	Refinery at Sulaymaniyah	NA
Phosphate rock		State Enterprise for Phosphate (Government)	Akashat	NA
Steel		State Enterprise for Iron and Steel Industries (Government)	Khor al Zubair	NA
Stone		State Enterprise for Raw Building Materials (Government)	Various locations	NA
Sulfur		Mishraq Sulphur State Enterprise (Government)	Mishraq 6/	NA

N/A Not available.
1/ Closed since 1990.
2/ Most natural gas produced in Iraq is associated with oil production, especially from the Ain Zalah, Bai Hassan, Butmah, Kirkuk, North Rumaila, South Rumaila, and Zubair Fields.
3/ Production capacity for all fields in 2001 was about 2.95 million barrels per day (1.1 billion barrels per year).
4/ Under development.
5/ Under construction.
6/ Sulfur was also recovered as a byproduct at oil refineries and natural gas plants.

Digitized by Google

Digitized by Google

THE MINERAL INDUSTRY OF

ISRAEL

By Thomas R. Yager

In 2001, Israel was a producer of such metals and metal products as lead, magnesium, steel, and zinc and such industrial minerals as bromine, bromine derivatives, flint clay, gypsum, kaolin, magnesia, phosphate rock, potash, silica sand, and sulfur. Building materials produced in Israel included cement, crushed stone, marble, and sand. The country also cut imported diamond and produced caustic soda, fertilizers, natural gas, petroleum and petroleum products, phosphoric acid, and sulfuric acid.

In 2001, Israel's gross domestic product (GDP) at purchasing power parity amounted to $118.4 billion; per capita GDP in 2000 amounted to $18,600 at purchasing power parity. The GDP decreased by 0.6% in 2001 after increasing by 6.4% in 2000, 2.6% in 1999, and 2.7% in 1998. In 2000, the constant dollar value of nonmetallic mineral products and production in the Israeli mining and quarrying industry fell by 8.3% and 2.3%, respectively, and chemicals and refined petroleum and metal rose by 3.4% and 1.9%, respectively. Chemicals and refined petroleum accounted for 9.9% of industrial production; nonmetallic minerals, 3.7%; mining and quarrying industry, 2.7%; and metal, 2.1% (Israel Central Bureau of Statistics, 2001, p. 20.13-20.15; International Monetary Fund, 2002, p. 158; 2002a§, b§).

In 2000, Israel's total exports amounted to nearly $28.3 billion. The value of fertilizer exports amounted to $418.4 million; metal exports, $279.3 million; refined petroleum products, $227.8 million; crude fertilizers and minerals, $175.2 million; and metalliferous ores and scrap, $52.8 million. Imports amounted to $35.2 billion, of which mineral fuels accounted for nearly $3.25 billion; iron and steel, $629 million; nonferrous metals, $424.8 million; and crude fertilizers and minerals, $168.9 million (Israel Central Bureau of Statistics, 2001, p. 16.7-16.8).

Commodity Review

Metals

Lead.—In 2001, Harkunas Lead Works, which was Israel's secondary lead smelter, increased its output owing to an expansion project that nearly doubled capacity to 25,000 metric tons per year (t/yr). Harkunas imported most of its lead scrap material from Eastern Europe; most of the plant's exports were shipped to Greece, Italy, and Spain (Metal Bulletin, 2000). The International Lead and Zinc Study Group (2002, p. 8) estimated that Israel's consumption of refined lead increased to 14,000 metric tons (t) in 2000 and 2001 from 12,000 t in 1999 and 11,000 t in 1998.

Magnesium.—Dead Sea Magnesium Ltd. (DSM) [a joint venture between Israel Chemicals Limited (ICL) (65%) and Volkswagen AG of Germany (35%)] operated a magnesium refinery with a capacity of 34,000 t/yr. The plant's raw material was carnallite from the Dead Sea, which was dehydrated, melted, and electrolytically refined to yield magnesium metal and chlorine.

Brines from the Dead Sea were exploited by Dead Sea Periclase Ltd. (DSP) (a subsidiary of ICL) in the production of magnesia. DSP produced 95,000 t/yr of magnesia, of which about 65,000 t/yr was dead-burned magnesia. About 13,000 t/yr of dead-burned magnesia was fused in-house by Taheto Dead Sea Fused Magnesia Company [a joint venture between DSP (50%) and Taheto Chemical Industries of Japan (50%)].

Other magnesium derivatives produced in Israel included magnesium chloride flakes and magnesium nitrate fertilizers, which were produced by the Dead Sea Works Ltd. (DSW) (a subsidiary of ICL) and Haifa Chemicals Ltd. (a subsidiary of Trans Resources Inc.), respectively.

Steel.—Yehuda Steel Ltd. operated rolling mills at Ashdod and Gedera and produced rebar rods for domestic consumption. The company also produced crude steel. In 2001, United Steel Mills Ltd. (USM) sold its rolling mill at Kiryat Gat to Israel-based Hod Metals. USM had previously sold its rebar fabricator Shovailit Steel and its steel mesh producer Maas Construction to Newman Building Steel Industries. In August 2001, USM entered liquidation when it shut down its facilities at Akko, which consisted of a meltshop, a rolling mill, and a scrap-processing plant. The fate of the plants at Akko remained undetermined at the end of 2001 (Metal Bulletin, 2002).

The International Iron and Steel Institute (2001, p. 82, 86, 92) estimated that Israel's imports of semimanufactured and finished steel products amounted to nearly 1.42 million metric tons (Mt) in 2000. This was a decrease from 1.62 Mt in 1999 and 1.49 Mt in 1995. From 1995 to 2000, Israel's apparent consumption of crude steel fell to 1.84 Mt from 1.87 Mt, and apparent consumption of finished steel fell to 1.65 Mt from 1.67 Mt.

Zinc.—Numinor Chemical Industries Ltd. used zinc scrap to produce refined zinc ingots, zinc powder, zinc oxide, and other zinc-containing materials. The company exported its products to African, Asian, and European countries. The International Lead and Zinc Study Group (2002, p. 40) estimated that Israel's consumption of refined zinc was 11,000 t/yr from 1999 to 2001.

Industrial Minerals

Bromine.—Brines and carnallite from the Dead Sea were extracted by the Dead Sea Bromine Group (DSBG) (a subsidiary of ICL). The company produced bromine as well as bromine derivatives with applications in air conditioning, batteries, cleaning solvents, flame retardants, mineral separation, oil drilling, photography, and water treatment; more than 90% of sales was from exports. DSBG accounted for 35% of world bromine production.

Digitized by Google

Cement.—Nesher Israel Cement Enterprises Ltd., which was the country's sole producer of cement, operated the Haifa, the Har-Tuv, and the Ramla plants. These plants had a total production capacity of 8 million metric tons per year (Mt/yr). International Cement Review (2001) forecast that Israel's cement consumption would increase to 5.15 Mt in 2001 from 5.1 Mt in 2000 and 5.05 Mt in 1998. Exports, which were destined mostly for the Gaza Strip and the West Bank, were expected to increase to 1.8 Mt in 2001 from 1.5 Mt in 1998. All imported cement came from Turkey, and clinker, from Croatia, Cyprus, Greece, and Turkey.

Diamond.—Fabrikant & Salant Ltd., L.L.D. Diamonds Ltd., and Schachter & Namdar Polishing Works Ltd. were the largest exporters of diamond in Israel. In 2001, the value of imported rough diamond amounted to $3.37 billion, which was a decrease from $3.95 billion in 1996. Nearly $1.03 billion of rough diamond was re-exported in 2001. From 1996 to 2001, the value of exported polished diamond increased to $4.53 billion from $4 billion. Nearly $1.79 billion of polished diamond was re-exported in 2001. Exports of polished diamond cut locally fell to about 1.37 million carats at a value of $2.74 billion in 2001 from 2.52 million carats at a value of $3.21 billion in 1996 (Even-Zohar, 2000§; International Diamond Exchange, 2002a§, b§).

Nitrogen.—In 2001, Israel imported 85,900 t (nitrogen content), which was an increase from 84,100 t in 2000 and a decrease from 89,600 t in 1999. Most ammonia imports were sourced from Ukraine. Israel also imported 7,600 t (nitrogen content) of urea in 2001. Fertilizers & Chemicals Ltd. (a subsidiary of ICL), Haifa Chemicals, and Rotem Amfert Negev Ltd. (a subsidiary of ICL) produced compound fertilizers, contained nitrogen, potassium, and phosphorous.

Phosphate Rock.—Israel's phosphate rock resources were exploited by Rotem; the company produced phosphoric acid and such fertilizers as monopotassium phosphate, single superphosphate, and triple superphosphate (TSP). Haifa Chemicals also produced phosphoric acid and phosphate fertilizers.

Preliminary figures for 2001 indicate that Rotem exported nearly 29% of its phosphate rock production. Brazil accounted for about 37% of phosphate rock exports; the Netherlands, 26%; India, 14%; Taiwan, 9%; and others, 14%. In 2000, nearly 76% of Israel's phosphoric acid production was exported. The Netherlands accounted for 40% of phosphoric acid exports; India, 34%; Turkey, 6%; Italy, 5%; and others, 15%. Israel also exported about 211,000 t of TSP and 7,000 t of monoammonium phosphate.

Potash.—Carnallite that contains potassium from the Dead Sea was exploited as raw material for DSW's potash plants. The company, which was the world's fourth largest producer of potash, planned to increase capacity to 3.25 Mt/yr from 2.8 Mt/yr. About 87% of domestic potash production was exported in 2000. Brazil accounted for 26% of Israel's potash exports; India, 19%; and China, 13% (Green Markets, 2000; Fertilizer Markets, 2001).

Haifa Chemicals, which was the world's largest producer of potassium nitrate, consumed DSW's potash in its production process. From 1995 to 1999, Israel's exports of potassium nitrate increased to 263,455 t at a value of $104.8 million from 203,730 t at a value of $86 million. In 1999, Spain accounted for nearly 35% of potassium nitrate exports; Italy, 13%; South Korea, 8%; France, 8%; and South Africa, 7% (International Trade Center and United Nations Statistics Division, 2001).

Silica Sand.—At the Hatira plant, Negev Industrial Minerals (NIM) (a subsidiary of ICL) mined and screened high-purity silica sand, which was consumed by the ceramics, construction, die casting, and flat and container glass industries. NIM's silica sand was used by Phoenicia America-Israel (Flat Glass) Ltd., which was Israel's sole producer of float and pattern glass. In 2000, Phoenicia's exports amounted to $47 million.

Sulfur.—From 1997 to 2000, Israel's production of sulfur averaged nearly 33,000 t/yr. Sulfur was produced at the Ashdod and the Haifa refineries, which were operated by Oil Refineries Ltd. (table 2). Most of Israel's demand for sulfur was met through imports, of which Russia accounted for 41%; Canada, 39%; Italy, 11%; and Germany, 9%. Sulfuric acid was produced by Rotem for the manufacture of fertilizers; about 68% of Israel's sulfuric acid was consumed in fertilizer production. In 2000, Israel consumed about 1.88 Mt of sulfuric acid, which was an increase from 1.82 Mt in 1998 and 938,000 t in 1995.

Mineral Fuels

Coal.—Israel had no coal reserves and was dependent upon imports of coal and petroleum for most of its energy needs. The country's consumption of coal increased to 10.31 Mt in 2000 from 9.26 Mt in 1999 and 6.57 Mt in 1995 (Israel Electric Corporation Ltd., undated, p. 20).

Natural Gas.—At the end of 2001, Israel's reserves of natural gas amounted to nearly 46 billion cubic meters. In March 2001, Israel Electric Corporation (IEC) announced that it would sign an agreement to purchase nearly 1.8 billion cubic meters per year of natural gas from Yam Thetis [a joint venture among Semedan Mediterranean (47%), Delek Drilling Ltd. (25.6%), Avner Oil Exploration LP (23%), and Delek Investments and Properties Ltd. (4.4%)]. The Noa and the Mari-B blocks would supply the gas to IEC's powerplants by the end of 2003 (Radler, 2001; Noble Affiliates, 2001§).

A joint venture among British Gas Group (BG), Delek Drilling Ltd., Isramco Inc., and Middle East Energy engaged in offshore exploration for natural gas at Med Ashdod and Med Yavne. In 2001, BG withdrew from the Gal C licenses; the company expected to decide whether to drill in the Gal A and the Gal B blocks by June 2002. BG also held licenses offshore Gaza (British Gas Group Plc, 2002, p. 19).

Petroleum.—From 1997 to 2000, Israel's production of petroleum declined by nearly 75% (table 1). Israel's petroleum reserves were not significant; most of the country's demand for crude petroleum was met through imports. At the end of 2001, Israel's reserves of crude petroleum were estimated to be 3.84 million barrels (Radler, 2001).

Digitized by Google

Oil Refineries Ltd. operated refineries in Haifa and Ashdod with capacities of 130,000 barrels per day (bbl/d) and 90,000 bbl/d, respectively. In 2000, Israel's exports of petroleum products increased to $227.7 million from $134.3 million in 1999 and $102 million in 1995 (Israel Central Bureau of Statistics, 1997, p. 228; 2001, p. 16.8).

Infrastructure

In 2000, the IEC produced 41,355 gigawatthours (GWh) of electricity, which was an increase from 37,656 GWh in 1999 and 29,504 GWh in 1995. Coal-fired powerplants accounted for nearly 71% of electricity generated; diesel, 24%; and natural gas and combined cycle, 5%. From 1995 to 2000, installed generating capacity increased to 9,129 megawatts (MW) from 6,920 MW. The largest powerplants were located at Orot Rabin, which had 2,590 MW; Rutenberg, 1,700 MW; Eshkol, 1,206 MW; Reading, 528 MW; and Haifa, 426 MW. The IEC planned to increase generating capacity to 11,918 MW in 2005 and 15,250 MW in 2010 (Israel Electric Corporation Ltd., undated, p. 16-17).

In 2000, Israel consumed 37,791 GWh of electricity, which was an increase from 34,298 GWh in 1999 and 26,986 GWh in 1995. The chemicals and petroleum sector consumed 1,754 GWh; nonmetallic mineral products, 741 GWh; mining and quarrying, 506 GWh; basic metal, 293 GWh; and diamond, 45 GWh (Israel Electric Corporation Ltd., undated, p. 36).

Israel's transportation network comprised nearly 16,000 kilometers (km) of paved highways and 610 km of railroads. There were 708 km of pipelines for crude oil, 290 km for petroleum products, and 89 km for natural gas.

Outlook

The outlook for Israel's bromine, lead, magnesium, phosphate, potash, and salt industries depends heavily upon world market conditions for these commodities, and the cement, crushed stone, gypsum, lime, and marble industries are more dependent upon the strength of the domestic economy. The International Monetary Fund (2002, p. 158) predicted that Israel's GDP would grow by 1.3% in 2002 and 3.8% in 2003; unrest owing to the collapse of the peace process could have substantial effects upon the economy in 2002.

The IEC's plans to build new powerplants and to convert existing plants from diesel fired to gas as well as increasing industrial demand could increase Israel's minimal consumption of natural gas to 4 billion cubic meters per year by 2005.

Global demand for bromine was expected to grow by 2% to 3% per year, but much stronger growth has been forecast for such bromine compounds as tetrabromobisphenol-A. Although world demand for magnesium was expected to grow by 6% per year through 2010, the market was likely to be oversupplied for several years. From 2001-02 to 2005-06, phosphate supply available for fertilizer was expected to increase by 1.6% per year, and phosphate fertilizer consumption, by nearly 2.6% per year. During the same period, potash supply available for fertilizer was expected to increase by nearly 0.7% per year, and potash fertilizer consumption, by 2.5% per year. Declining global mine output in 2002 and rising consumption in 2003 were expected to result in higher lead prices (Kendall, 2000; Burstow, 2001; Food and Agricultural Organization of the United Nations, 2001; SG Securities Ltd., 2001; Twidale, 2001).

References Cited

British Gas Group Plc, 2002, 2001 annual report and accounts: Reading, United Kingdom, British Gas Group Plc, 129 p.

Burstow, Clive, 2001, Supply side holds key to Mg: Metal Bulletin, no. 8549, February 12, p. 11.

Fertilizer Markets, 2001, DSW sales up to Brazil, elsewhere: Fertilizer Markets, February 23, p. 2-3.

Food and Agricultural Organization of the United Nations, 2001, Current world fertilizer trend and outlook to 2005/2006: Rome, Italy, Food and Agricultural Organization of the United Nations, 14 p.

Green Markets, 2000, Potash—Israel: Green Markets, v. 24., no. 8, July 10, p. 8.

International Cement Review, 2001, Israel, *in* The global cement report: Dorking, United Kingdom, Tradeship Publications, Ltd., p. 171-172.

International Iron and Steel Institute, 2001, Steel statistical yearbook 2001: Brussels, Belgium, International Iron and Steel Institute, 109 p.

International Lead and Zinc Study Group, 2002, Table 31. Refined zinc—Metal consumption: Lead and Zinc Statistics, v. 42, no. 5, May, 67 p

International Monetary Fund, 2002, World economic outlook—Recoveries and recessions: Washington, DC, International Monetary Fund, April, 225 p.

International Trade Center and United Nations Statistics Division, 2001, Trade Analysis System on personal computer: New York, New York, International Trade Center and United Nations Statistics Division CD-ROM.

Israel Central Bureau of Statistics, 1997, Statistical abstract of Israel 1997: Jerusalem, Israel, Israel Central Bureau of Statistics, 704 p.

Israel Central Bureau of Statistics, 2001, Statistical abstract of Israel 2001: Jerusalem, Israel, Israel Central Bureau of Statistics, 899 p.

Israel Electric Corporation Ltd., [undated], Statistical report 2000: Haifa, Israel, Israel Electric Corporation Ltd., 66 p.

Kendall, Tom, 2000, Fertilisers bear fruit—IM projects in Jordan and Saudi Arabia: Industrial Minerals, no. 398, November, p. 49-53.

Metal Bulletin, 2000, Harkunas expansion nears completion: Metal Bulletin, no. 8517, October 16, p. 14.

Metal Bulletin, 2002, Delays on USM decision irritate Israeli market: Metal Bulletin, no. 8651, February 21, p. 20.

Radler, Marilyn, 2001, World crude, gas reserves expand as production shrinks: Oil & Gas Journal, v. 99, no. 52, p. 125-127.

SG Securities Ltd., 2001, Quarterly Metals Review—A mountain to climb: London, United Kingdom, SG Securities Ltd., October, 28 p.

Twidale, Susanna, 2001, Overcapacity in magnesium market is set to continue: Metal Bulletin, no. 8577, May 24, p. 8.

Internet References Cited

Evan-Zohar, Chaim, 2000 (January 6), Israel records $4.5 billion net polished exports in 1999, accessed May 8, 2002, at URL http://www.diamondconsult.com/TACY-Articles/jan06999.htm.

International Diamond Exchange, 2002a (January 3), Israeli polished figures for December 2001, accessed April 3, 2002, at URL https://www.idexonline.com/art030102-01.asp.

International Diamond Exchange, 2002b (January 3), Israeli rough figures for December 2001, accessed May 8, 2002, at URL https://www.idexonline.com/art030102-02.asp.

International Monetary Fund, 2002a (April 18), Selected world aggregates, World Economic Outlook Database, accessed April 23, 2002, at URL http://www.imf.org/external/pubs/ft/weo/2002/01/data/w1.csv.

International Monetary Fund, 2002b (April 18), Shares of aggregate GDP based on purchasing power parity (PPP) valuation of country GDP—Developing countries, World Economic Outlook Database, accessed April 23, 2002, at URL http://www.imf.org/external/pubs/ft/weo/2002/01/data/ppp_a.csv.

Noble Affiliates, 2001 (March 14), Noble Affiliates announces selection as Israeli gas supplier, accessed May 10, 2002, at URL http://www.prnewswire.com/cgi-bin/stories.pl?ACCT=105&STORY=/www/story/03-14-2001/0001447704.

Digitized by Google

TABLE 1
ISRAEL: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity 3/		1997	1998	1999	2000	2001 e/
METALS						
Iron and steel, steel, crude		270,000 r/	280,000 r/	280,000	270,000 r/ e/	220,000
Lead, refined secondary		12,000	12,000	13,000	13,000 r/	20,000
Magnesium metal		7,400 r/	24,500 r/	24,800 r/	31,700 r/	31,700
INDUSTRIAL MINERALS						
Bromine:						
Elemental		180,000	185,200	181,000 r/	210,000 r/	206,000
Compounds e/		243,000 r/	247,000 r/	247,000 r/	250,000 r/ 5/	250,000
Caustic soda e/		41,700	41,700	41,200	44,200 r/	44,900
Cement, hydraulic	thousand tons	5,400	6,476	6,354	6,600 e/	6,900
Clays:						
Brick clay		40,000	84,000	40,000	35,000	35,700
Flint clays		45,000	23,000	17,000 r/	-- r/	--
Kaolin		16,000	27,000	20,000 r/	13,000 r/	13,300
Diamonds 4/	thousand carats	2,373	1,795	1,833	1,672 r/	1,367 5/
Gypsum		120,875	56,484 r/	140,000 r/	130,000 r/	133,000
Lime		344,000	378,000	340,000 r/	350,000 r/	299,000
Magnesia, Mg content		53,300 e/	57,000 e/	57,000	57,000	55,000
Nitrogen, N content of ammonia and urea		56,600	500	--	--	-- 5/
Phosphate:						
Phosphate rock:						
Beneficiated	thousand tons	4,047	4,067	4,128	4,110	3,511 5/
P_2O_5 content	do.	1,260	1,288	1,310	1,305 r/	1,115 5/
Phosphatic fertilizers, P_2O_5 equivalent: e/						
Monoammonium phosphate		--	7,600	7,300	11,000	10,300
Triple superphosphate		144,000	165,000	250,000	115,000	108,000
Phosphoric acid, P_2O_5 equivalent e/		630,000	650,000	725,000 r/	520,000 r/	488,000
Potash, K_2O equivalent	thousand tons	1,488	1,668	1,702	1,748 r/	1,774 5/
Salt, marketed (mainly marine)	do.	750	874	538 r/	526 r/	537
Sand:						
Silica sand		275,000	257,000	320,000 r/	300,000 r/	306,000
Other	thousand tons	11,000	9,000	11,000 r/	10,500 r/	10,700
Sodium and potassium compounds, caustic soda e/		30,400	30,400	30,000	32,200 r/	32,700
Stone:						
Crushed	thousand tons	35,000	33,000	30,000 r/	29,000 r/	29,600
Dimension, marble		83,400 r/	102,860 r/	94,520 r/	127,880 r/	131,000
Sulfur:						
Byproduct from petroleum	thousand tons	30	32	31	38 r/	39
Sulfuric acid						
Gross weight	thousand tons	1,343 r/	1,685 r/	1,814 r/	1,875 r/	1,910
S content	do.	439	551	593	613	624
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	thousand cubic meters	18,992 r/	11,938 r/	10,739 r/	9,653 r/	9,500
Dry	do.	18,992 r/	11,938 r/	10,739 r/	9,653 r/	9,500
Petroleum:						
Oil shales		471,800	443,900	449,400	390,000 r/	396,000
Crude	42-gallon barrels	98,300 r/	40,800 r/	29,400 r/	25,000 r/	25,000
Refinery products:						
Liquified petroleum gas	thousand 42-gallon barrels	3,566	3,509	3,755 r/	4,285 r/	4,360
Gasoline	do.	17,107	17,080	16,834 r/	16,704 r/	17,000
Naptha	do.	6,369	7,287	7,867 r/	7,915 r/	8,040
Kerosene	do.	7,734	8,189	8,702	8,850 r/	8,990
Distillate fuel oil	do.	14,308	15,573	12,927 r/	17,261 r/	17,500
Residual fuel oil	do.	9,688	9,584	9,740 r/	9,267 r/	9,420
Other e/	do.	4,320	5,270	5,360 r/	5,050 r/	5,130
Total	do.	63,092	66,492	65,185 r/	69,332 r/	70,400

e/ Estimated. r/ Revised. -- Zero.

1/ Table includes data available through May 10, 2002.

2/ Estimated data are rounded to no more than three significant digits; may not add to totals shown.

3/ In addition to the commodities listed, imported gemstones are cut, and secondary refined zinc, such fertilizers as monopotassium phosphate, and a variety of crude construction materials are produced, but available information is inadequate to make estimates of output.

4/ Imported diamond cut in Israel.

5/ Reported figure.

Digitized by Google

TABLE 2
ISRAEL: STRUCTURE OF THE MINERALS INDUSTRY IN 2001

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Bromine 1/	Dead Sea Bromine Group [Israel Chemicals Ltd. (ICL), 100%]	Sdom	250 bromine.
Cement	Nesher Israel Cement Enterprises Ltd.	Haifa, Har-Tuv, and Ramla	5,000 clinker.
Do.	do.	do.	8,000 cement.
Lead, refined secondary	Harkunas Lead Works	Ashdod	25.
Magnesium:			
Magnesia	Dead Sea Periclase Ltd. (DSP) (ICL, 100%)	Mishor Rotem	95.
Do.	Tateho Dead Sea Fused Magnesia Co. (DSP, 50%; Tateho Chemical Industries Co. of Japan, 50%)	do.	13.
Magnesium, refined	Dead Sea Magnesium Ltd. (ICL, 65%; Volkswagen AG of Germany, 35%)	Sdom	34.
Petroleum:			
Crude thousand barrels	Lapidoth Israel Oil Prospectors Corp.	Heletz-Brur	20.
Do. do.	do.	Kochav	5.
Refined do.	Oil Refineries Ltd. (Government, 100%)	Haifa	47,500.
Do. do.	do.	Ashdod	32,800.
Potassium:			
Potash	Dead Sea Works (DSW) (ICL, 100%)	Sdom	2,800.
Potassium nitrate	Haifa Chemicals	Haifa	300.
Do.	do.	Mishor Rotem	200.
Phosphate:			
Phosphate rock	Rotem Amfert Negev Ltd. (ICL, 100%)	Arad, Oron, and Zin	5,500.
Phosphatic fertilizers 2/	do.	Rotem	50 monopotassium phosphate.
Do.	do.	do.	NA.
Do.	Haifa Chemicals	Haifa	NA.
Phosphoric acid 3/	Rotem Amfert Negev Ltd. (ICL, 100%)	Rotem	640.
Do.	Haifa Chemicals	Haifa	NA.
Salt	DSW		700.
Do.	Israel Salt Industries Ltd. (subsidiary of Danker Group)	Atlit, Eilat, and Kalia	NA.
Steel:			
Crude	United Steel Mills Ltd.	Akko	200.
Do.	Yehuda Steel	Ashdod	150.
Rebar	do.	Gedera	230.
Do.	do.	Ashdod	120.
Do.	United Steel Mills Ltd.	Akko	220.
Do.	Hod Metals	Kiryat Gat	100.
Sulfur	Oil Refineries Ltd.	Ashdod	40.
Do.	do.	Haifa	33.
Sulfuric acid 4/	Rotem Amfert Negev Ltd. (ICL, 100%)	Rotem	NA.
Zinc	Numinor Chemical Industries Ltd.	Maalot	NA.

NA Not available.

1/ Capacity of bromine derivatives is at least 250,000 metric tons per year (t/yr) based on recent production data.

2/ National capacity of triple superphosphate is at least 250,000 t/yr P_2O_5 equivalent; and monoammonium phosphate, at least 11,000 t P_2O_5 equivalent based on recent production data.

3/ P_2O_5 equivalent.

4/ Capacity of sulfuric acid is estimated to be at least 1.91 million metric tons per year based on recent production data.

Digitized by Google

Digitized by Google

THE MINERAL INDUSTRIES OF

JORDAN, LEBANON, AND SYRIA

By Thomas R. Yager

JORDAN

In recent years, Jordan has been a major producer and exporter of potash and phosphate rock. It has also produced such industrial minerals as feldspar, gypsum, kaolin, salt, and silica sand and such building materials as cement, dimension stone, limestone, and marble. Natural gas and petroleum products have been produced for domestic consumption. Deposits of copper, gold, iron, sulfur, and titanium were found in Jordan, and bromine and magnesium occur in the Dead Sea.

In 2001, Jordan's gross domestic product (GDP) amounted to about $19.4 billion at purchasing power parity, and per capita income at purchasing power parity was nearly $3,800. GDP at market exchange rates was $8.8 billion. Jordan's GDP grew by 4.2% in 2001 after increasing by 4% in 2000, 3.1% in 1999, and 3% in 1998. The output of the manufacturing sector amounted to 15.9% of the GDP; construction, 5.5%; mining and quarrying, 3%; and electricity and water, 2.6% (Central Bank of Jordan, 2002, p. 83; International Monetary Fund, 2002, p. 165; 2002a§[1]-c§).

In 2001, the construction sector grew by 11.1%, and the mining and quarrying sector, by 4.1%. From 1997 to 2001, the mining and quarrying and construction sectors grew by an average of 1.8% per year and 0.1%, respectively (Central Bank of Jordan, 2002, p. 83).

In 2001, total exports were valued at $1.91 billion; of that stone, cement, fertilizers, phosphate rock, phosphoric acid, potash, and sulfuric acid totaled $541 million. In the same year, total imports were valued at $4.85 billion. Imports of crude petroleum amounted to $544.9 million; iron and steel products, $213.7 million; refined petroleum products, $114 million; crude minerals and crude fertilizers, $34.8 million; and ammonia, $25.8 million (Central Bank of Jordan, 2002, p. 64-67).

Metals

Magnesium.—Jordan Magnesia Company [a subsidiary of Arab Potash Company (APC)] was building a plant to produce about 50,000 metric tons per year (t/yr) of refractory-grade magnesia and 10,000 t/yr of other grades of magnesia for chemical, environmental, fertilizer, and plastic applications. Magnesium will be extracted from the Dead Sea's plentiful resources of magnesium chloride. The $80 million plant was expected to start production by mid-2002 (Dougherty, 2001).

APC was engaged in a feasibility study for a magnesium chloride flakes plant with a capacity of from 100,000 to 300,000 t/yr. The company was also considering the possibility of producing magnesium metal, but Jordan's high energy costs may render its production uneconomic (Scott, 2001).

Steel.—A new antitrust law was expected to come into effect in November 2002. This law would force increased competition in the Jordanian steel industry, which was plagued by severe overcapacity. The country's total rolling capacity was estimated to be 1 million metric tons per year (Mt/yr), but production was only 270,000 metric tons (t) in 2000 (table 1). Most of Jordan's steel companies reported losses from 1996 to 1999 (Metal Bulletin, 2002).

The International Iron and Steel Institute (2001, p. 82, 92) estimated that Jordan's imports of semimanufactured and finished steel products amounted to 387,000 t in 2000. This was an increase from 354,000 t in 1999, but a decrease from 554,000 t in 1995. From 1995 to 2000, Jordan's apparent consumption of finished steel fell to 405,000 t from 572,000 t. Most of the billet needed to produce Jordan's rebar was sourced from Russia, Turkey, and Ukraine.

Industrial Minerals

Bromine.—In 2001, Jordan Bromine Co. Ltd. (a joint venture of APC and the U.S.-based Albemarle Holding Co. Ltd.) started building a plant to produce bromine and bromine compounds. The $150 million plant was expected to be operational at the end of 2003. It would have production capacity for elemental bromine of 50,000 t/yr; caustic soda, 49,000 t/yr; calcium bromide, 30,000 t/yr; chlorine, 30,000 t/yr; and hydrochloric acid, 12,000 t/yr. Jordan Bromine also started construction on a tetrabromobisphenol-A (TBBA) plant with an initial production capacity of 12,500 t/yr. This plant could be quickly expanded to 37,500 t/yr (Arab Petroleum Research Center, 2001a, p. 202-203; Arab Potash Company, 2001§).

Cement.—The Lafarge Group held a 44% share in Jordan Cement Factories Co. Ltd. (JCF), which was Jordan's largest producer of cement. JCF had two plants in Fuhia and Rashadia with a combined capacity of 4.5 Mt/yr of cement and 3.8 Mt/yr of clinker. Lafarge planned to reduce production costs by substituting petroleum coke for diesel. The Arab Company for White Cement Industry operated a plant with a capacity of 130,000 t/yr; about 50% of the company's product was exported (International Cement Review, 2001a).

Jordan's cement consumption averaged about 2.25 Mt/yr from 1998 to 2000. In 2001, consumption was estimated to have increased to about 2.4 million metric tons (Mt). Housing accounted for 69% of domestic cement consumption; commercial building projects, 20%; and industrial uses, 11%. In recent years, cement has been exported to Bangladesh, Egypt, Eritrea, Saudi

[1]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

Arabia, Sudan, and Yemen. From 1997 to 2001, cement exports fell to $35.7 million from $47.2 million (International Cement Review, 2001a; Central Bank of Jordan, 2002, p. 64-65).

Phosphate Rock.—Jordan Phosphate Mines Company (JPMC) produced phosphate rock from three mines. JPMC planned to increase production at the Shiyada Mine, which was the largest, to 7.4 Mt/yr in 2003. Conditions in the global phosphate markets and technical problems at Shiyada's beneficiation plant forced these plans to be delayed. The Al-Abiad and the Al- Hasa Mines were expected to be subeconomic by 2006, and resources at the Al-Rusaifa Mine have already been depleted. In January 2001, the Government approved the privatization of JPMC, which was scheduled to be completed by March 2002 (Arab Petroleum Research Center, 2001a, p. 201-202; Goussous, 2001; Kendall, 2000).

Phosphoric acid was produced by Indo-Jordan Chemicals Company (IJC) and Jordan Fertilizer Industry Company (JFIC). In 2000, Southern Petrochemicals Industry Corp., which was the largest shareholder in IJC, discussed the possibility of increasing phosphoric acid production capacity to 462,000 t/yr from 225,000 t/yr. JFIC and IJC accounted for 24% and 16%, respectively, of JPMC's phosphate rock sales. The two companies also produced such fertilizers as diammonium phosphate (DAP); from 1998 to 2000, JFIC's production of DAP fell by about 36% (Kendall, 2000; Goussous, 2001).

In December 2000, Norsk Hydro decided to discontinue its joint venture with JPMC in the Hydro Agri Jordan phosphoric acid and fertilizer project. The two companies had originally planned to build a phosphoric acid plant with a capacity of 440,000 t/yr and a fertilizer plant with a capacity of 1.2 Mt/yr. Norsk Hydro indicated that it planned to give higher priority to other investment opportunities in its core business areas (Industrial Minerals, 2001a).

Exports of phosphate rock fell to $129.9 million in 2001 from $190 million in 1997. In 2000, about 60% of JPMC's sales were to export markets; of that 60%, India absorbed 61.5%, and Indonesia, 14%. In 2001, exports of phosphoric acid rose to $52.3 million from $3.1 million in 1997. During the same period, exports of fertilizers fell to $86.3 million from $134.9 million (Goussous, 2001; Central Bank of Jordan, 2002, p. 64- 65).

Potash.—APC recovered potassium from the Dead Sea to produce potash; the company was one of the world's largest potash producers with a capacity of 2.0 Mt/yr. Capacity was expected to increase to 2.4 Mt/yr of potash in 2004. In January 2001, the Government approved the privatization of APC, which was scheduled to be completed in March 2002. In 2001, exports of potash increased to $195.4 million from $139.2 million in 1997 (Arab Petroleum Research Center, 2001a, p. 201-202; Central Bank of Jordan, 2002, p. 64-65).

In 1998, APC and Kemira Agro OY formed a joint venture to produce 150,000 t/yr of potassium nitrate fertilizer and 75,000 t/yr of dicalcium phosphate animal feed supplement. Production was expected to start in 2002.

Salt.—The salt deposit in the Azraq depression was exploited by Al Azraq, and Dead Sea salt was exploited by the Jordan Safi Salt Company (JOSSCO), which was 52.7% owned by APC. JOSSCO's plant had a capacity of 1.2 Mt/yr of industrial salt and 32,000 t/yr of table salt. At the end of 2000, APC agreed to sell a 40% stake in JOSSCO to Qatari Salt Processing and Production Company. The agreement was not finalized; in May 2001, APC announced that it would acquire a 100% interest in JOSSCO (Arab Petroleum Research Center, 2001a, p. 202).

Sulfur.—Jordan's domestic sulfur resources occur mostly in unexploited oil shale; IJC and JFIC produced sulfuric acid from imported sulfur. Saudi Arabia accounted for 82% of sulfur imports, and the United Arab Emirates, 18%. In 2000, Jordan consumed about 1.76 Mt of sulfuric acid, which was an decrease from 1.8 Mt in 1999 and an increase from 987,000 t in 1995. About 86% of Jordan's sulfuric acid was consumed in the manufacture of fertilizers.

Mineral Fuels

Natural Gas.—National Petroleum Company planned to explore for additional resources at Risha, which was Jordan's only known gasfield. The Governments of Cyprus, Egypt, Jordan, Lebanon, and Syria agreed to build a pipeline that would supply Egyptian and Syrian natural gas to Jordan, Lebanon, and Cyprus. Jordan would purchase 1 billion cubic meters per year of natural gas for 15 years starting in 2003 (Lidstone, 2002).

Petroleum.—Although minimal production at the Hamza oilfield continued in 2001, Jordan depended upon Iraq for most of its supplies of crude petroleum. Imports of crude petroleum increased to $544.8 million in 2001 from $410.8 million in 1997. In November 2000, the Governments of Iraq and Jordan revived their plan to build a pipeline to transport Iraqi oil to Jordan's refinery at Zarqa. Work on the pipeline was expected to start in late 2001 (Arab Petroleum Research Center, 2001a, p. 195, 200; Central Bank of Jordan, 2002, p. 67-68).

In May, Suncor Energy Inc. resumed negotiations with the Government to develop the Lejjun oil shale reserves. If Suncor proceeds with the project, then it would plan to produce 17,000 barrels per day (bbl/d) of crude petroleum in 2006, 67,000 bbl/d in 2011, and 210,000 bbl/d in 2014 (Arab Petroleum Research Center, 2001a, p. 196).

Jordan Petroleum Refinery Company (JPRC) operated the country's only refinery at Zarqa, which had a nominal capacity of 90,400 bbl/d. JPRC was studying a proposal for a $400 million to $500 million upgrade and expansion of the refinery. About $200 million to $300 million would be needed to reduce the sulfur content of the refinery's products, and $200 million, to increase capacity to 150,000 bbl/d. Imports of petroleum products increased to $114 million from $96.7 million (Arab Petroleum Research Center, 2001a, p. 196; Central Bank of Jordan, 2002, p. 67-68).

Infrastructure

Jordan produced 7,366 gigawatt-hours (GWh) of electricity in 2001, which was an increase from 7,208 GWh in 2000 and

Digitized by Google

6,180 GWh in 1997. Fossil fuels accounted for 99.6% of electricity production, and hydroelectric sources, 0.4%. About 11% of Jordan's electricity was generated from natural gas. The country's electricity demand was expected to increase to 10,000 GWh in 2005 and 12,500 GWh in 2010 (Arab Petroleum Research Center, 2001a, p. 198; Central Bank of Jordan, 2002, p. 88).

Installed generating capacity was 1,578 megawatts (MW) in 2000. Jordan's largest powerplants were the 650-MW Aqaba plant and the 400-MW Zarqa plant. Planned expansions of capacity included a new 450-MW plant at al-Samra; a 100- to 300-MW oil shale plant in the Sultani area; a 100- to 150-MW gas-powered plant; three 25- to 30-MW wind-powered plants; a 30-MW solar plant at Wadi Rum; and a hydroelectric plant at Wihdeh. Jordan's known exploitable potential hydroelectric energy was 87 MW (World Resources Institute and others, 1996, p. 288; Arab Petroleum Research Center, 2001a, p. 199).

Outlook

Jordan did not consume substantial quantities of bromine or magnesium; the success of APC's projects would depend upon world market conditions for these commodities. Global demand for bromine was expected to grow by 2% to 3% per year, but much stronger growth has been forecast for bromine compounds, such as TBBA. Although world demand for magnesium was expected to grow by 6% per year through 2010, the market was likely to be oversupplied for several years (Kendall, 2000; Burstow, 2001; Twidale, 2001).

From 2001-02 to 2005-06, phosphate supply available for fertilizer was expected to increase by 1.6% per year, and phosphate fertilizer consumption, by nearly 2.6% per year. During the same period, potash supply available for fertilizer was expected to increase by nearly 0.7% per year, and potash fertilizer consumption, by 2.5% per year (Food and Agricultural Organization of the United Nations, 2001). The majority of JPMC's production was exported; in addition to the growth in world markets, the company was also expected to benefit from its impending privatization.

Jordan's economy was expected to grow by 5.1% in 2002 and 6% in 2003. The strength of the domestic economy could lead to higher demand for consumer durables, as well as cement and other building materials.

LEBANON

The Lebanese minerals industry continued its historically small contribution to the country's economy. In recent years, Lebanon has been known to produce cement, gypsum, lime, phosphatic fertilizers, phosphoric acid, salt, semimanufactured steel, and sulfuric acid for domestic consumption. Modest deposits of asphalt, coal, and iron ore occur in Lebanon.

In 2001, Lebanon's GDP amounted to about $28.4 billion at purchasing power parity; per capita income at purchasing power parity was nearly $8,100. The GDP at market exchange rates was $16.7 billion. The GDP grew by 1.3% in 2001 after not changing in 2000 and increasing by 1% in 1999 and 3% in 1998 (International Monetary Fund, 2002, p. 165; 2002a§-c§).

In 2000 and the first half of 2001, exports of cement amounted to about 3% of Lebanon's total exports. The country's cement factories were owned by Société des Ciments Libanais, which had a capacity of 2.2 Mt/yr; Cimenterie Nationale SAL, 1.6 Mt/yr; and Ciment de Sibline, 1.2 Mt/yr. In 2001, Cimenterie Nationale decided to increase capacity at two of its cement mills by adding a primary grinding circuit (International Cement Review, 2001b).

Lebanon imported phosphate rock from Syria to produce phosphoric acid and fertilizers, such as triple superphosphate. From 1998 to 2000, Lebanese imports of phosphate rock increased by about 21%. The country also imported sulfur to manufacture sulfuric acid. Spain accounted for 30% of sulfur imports; France, 26%; Saudi Arabia, 24%; and Lebanon, 20%. From 1995 to 2000, Lebanon's consumption of sulfuric acid increased from 189,000 t to 357,000 t; 77% was consumed in the production of fertilizers.

In 2000, the production of semimanufactured steel increased to 80,000 t from 55,000 t in 1999. The International Iron and Steel Institute (2001, p. 92) estimated that Lebanon's consumption of finished steel increased to 454,000 t in 2000 from 170,000 t in 1995.

Because Lebanon has no petroleum or gas reserves, the country relies on imports for its energy requirements. In 2000, the value of imported petroleum products amounted to nearly $1.14 billion, which was an increase from $810 million in 1999 and $624 million in 1998. About 34 million barrels (Mbbl) of petroleum products were imported in 2000, of which fuel oil accounted for 58%; gasoline, 32%; and other, 10% (Arab Petroleum Research Center, 2001b, p. 241).

In 2001, the Government revived plans to rebuild the Tripoli and the Zahrani refineries. The Tripoli refinery would produce from 50,000 to 60,000 bbl/d by the end of 2003 and 150,000 bbl/d in 2005. The Zahrani refinery was also expected to produce 150,000 bbl/d by the end of 2005 (Middle East Economic Digest, 2001b).

Electricité du Liban (EdL), which was a state-owned company, estimated that converting diesel power stations to natural gas could save Lebanon $100 million per year and improve the country's environment. Under the agreement signed with the Governments of Egypt, Jordan, and Syria, Lebanon would import 4.4 billion cubic meters per year of natural gas. Egypt would supply 75% of the gas, and Syria, 25% (Arab Petroleum Research Center, 2001b, p. 242).

Lebanon's known exploitable potential hydroelectric energy is 1,000 MW. The production of electricity amounted to 9,111 GWh in 2000. Fossil fuels accounted for 91% of the electricity generated and hydroelectric power, 9%. Lebanon's installed generating capacity was 2,150 MW at the beginning of 2001, although effective operating capacity was estimated to be no more than 1,450 MW. In 2000, total consumption amounted to 1,600 MW of capacity; EdL was forced to ration electricity and to import about 150 MW of capacity from Syria (World Resources Institute and others, 1996, p. 289; Arab Petroleum Research Center, 2001b, p. 243).

EdL estimated that the rising demand for electricity and the decommissioning of the 331-MW Jieh and 65-MW Al Haricha powerplants would necessitate the installation of 750 MW of

Digitized by Google

new capacity by 2005. In February 2001, the need to finance new powerplants and EdL's losses of $64 million per year spurred the Government to endorse the privatization of EdL. The sale was scheduled to take place in 2003. In November 2001, Enel Group of Italy signed contracts with EdL for the operation and maintenance of the Deir Ammar and the Zahrani powerplants (Arab Petroleum Research Center, 2001b, p. 243; Middle East Economic Digest, 2001a).

Lebanon's transportation network comprised about 7,300 kilometers (km) of roads, of which 6,200 km was paved. Railroad track totaled 399 km, most of which was damaged during the civil war. The country had 72 km of crude oil pipelines, but none was operational. Ports and harbors were Beirut, Sidon, Tripoli, and Tyre.

The success of the Lebanese minerals industry depends upon the long-term restoration of peace and stability to the country. The short-term outlook is for slow economic growth; the domestic consumption of cement and steel is not likely to change substantially. Rising cement demand in Syria may provide opportunities for exports. See the section on Jordan for a discussion of the world market outlook for phosphate fertilizers.

SYRIA

The Middle Eastern nation of Syria was a producer of dimension stone, fertilizers, industrial minerals, natural gas, oil, sand and gravel, and semimanufactured goods. Industrial minerals produced in recent years include gypsum, phosphate rock, salt, silica sand, and sulfur. Semimanufactured goods included cement, glass, phosphoric acid, steel, and sulfuric acid.

Syria's 2001 GDP at purchasing power parity was estimated to be $57.9 billion; per capita GDP at purchasing power parity was nearly $3,500. GDP at market exchange rates was $19.5 billion. In 2001, Syria's GDP increased by 3.5% after rising by 2.5% in 2000 and falling by 2% in 1999. The oil and gas industry accounted for nearly three-quarters of Syria's total export earnings and more than one-third of its GDP (International Monetary Fund, 2002, p. 165; 2002a§-c§).

In 2001, the Government of Syria announced its intentions to open the country's mineral industry to local and foreign private investors. Planned incentives for investors included a 7-year tax holiday and reduced duties on imported raw materials (Industrial Minerals, 2001b).

Commodity Review

Metals

Syria's need for infrastructure development led the Government to open the steel industry to private investment. Joud International was building the Joudco Steel plant, which was a $12 million to $15 million rebar and sections rolling mill with a capacity of 150,000 t/yr. Saudi financiers provided the funds for Arab Steel Co., which was a proposed rolling mill with a capacity of 250,000 t/yr. The Joudco Steel plant was expected to start production at the end of 2001, and Arab Steel, in April 2002. A third project with a capacity of 300,000 t/yr of rebar and sections was financed from several sources, which included Jordan (Metal Bulletin, 2001).

The International Iron and Steel Institute (2001, p. 82, 92) estimated that Syria's imports of semimanufactured and finished steel products amounted to 1.26 Mt in 2000, which was an increase from 888,000 t in 1999 and 369,000 t in 1995. From 1995 to 2000, Syria's apparent consumption of finished steel rose to about 1.13 Mt from 329,000 t.

Industrial Minerals

Cement.—International Cement Review (2001c, p. 282) estimated that Syria's consumption of cement increased to 5.16 Mt in 2001 from 4.73 Mt in 1998. During the same period, imports increased to 300,000 t from 200,000 t. Syria's actual demand for cement was estimated to be more than 6 Mt/yr (Middle East Online, 2001§).

Seven state-owned but independently operated companies within the General Organization for Cement and Building Materials produced cement from nine plants with a combined capacity of 5.16 Mt/yr. The largest companies were Tartous Company for Cement and Building Materials with a capacity of 1.8 Mt/yr and al-Chahba Cement and Building Materials with a capacity of 920,000 t/yr (International Cement Review, 2001c, p. 283).

In July, the Government announced its intentions to increase national cement production capacity to 8 Mt/yr. Edhas Sanat Company of Iran planned to build a plant with a capacity of 1 Mt/yr that would be operational in mid-2004. The Kuwaiti Fund for Arab Economic Development planned to contribute $70 million to this project. Edhas Sanat was also involved with upgrading the capacity of the 850,000-t/yr plant operated by Adra Company for Cement and Building Materials. Hassan Allam Group and other Egyptian, Saudi, and Syrian investors planned to build a cement plant in Abu Shamat at a cost of $540 million (International Cement Review, 2001c, p. 283; Middle East Online, 2001§).

Gravel and Other Construction Materials.—The production of dimension stone, dolomite, and gypsum fell in 2000, and the production of gravel increased (table 1). In 2000, the value of gravel produced in Syria amounted to $5.55 million; dolomite, $4.91 million; volcanic tuff, $1.52 million; gypsum, $561,000; and dimension stone, $560,000 (Talal Ballaneh, General Establishment of Geology and Mineral Resources, written commun., 2001).

Nitrogen.—General Fertilizer Company (GFC) [a subsidiary of the General Establishment for Chemical Industries (GECI)] produced ammonia, urea, and such nitrogenous fertilizers as ammonium nitrate and calcium nitrate for domestic consumption. From 1997 to 2000, production of ammonia and urea averaged 104,000 t/yr and 66,000 t/yr, respectively. In 2001, Syria produced about 100,000 t of nitrogenous fertilizers. Financial constraints have prevented the construction of a nitrogenous fertilizer plant with a capacity of 365,000 t/yr of ammonia and 639,000 t/yr of urea (Arab Petroleum Research Center, 2001c, p. 444).

Phosphate Rock.—General Company for Phosphate and Mines (GECOPHAM) operated the Eastern A, the Eastern B,

Digitized by Google

and the Kneifis phosphate rock mines, which had a combined capacity of 2.65 Mt/yr. Phosphate rock was consumed by GFC's phosphoric acid and triple superphosphate (TSP) fertilizer plants in Homs. In 2000, the value of phosphate rock production amounted to $38.2 million (Fertilizer International, 2001; Talal Ballaneh, General Establishment of Geology and Mineral Resources, written commun., 2001).

Syria's domestic production of phosphate fertilizers met only 63% of domestic demand; Bechtel Corp. and Makad International planned to build a 500,000-t/yr TSP plant near Palmyra. Financial constraints have prevented the implementation of this project (Arab Petroleum Research Center, 2001c, p. 444).

Syria was the world's fifth largest exporter of phosphate rock; about 74% of Syria's phosphate rock was exported in 2000. Lebanon accounted for 34% of exports; Romania, 9%; Greece, 7%; Portugal, 7%; and others, 43%. Most phosphate rock exported from Syria was used to produce single superphosphate (Fertilizer International, 2001).

Salt.—GECOPHAM produced salt from the Tibni Mine and three salt lakes, which included Mamlahat al Jabbul. From 1997 to 2000, salt production averaged nearly 127,000 t/yr (table 1). In 2000, the value of salt produced in Syria amounted to $3.5 million (Talal Ballaneh, General Establishment of Geology and Mineral Resources, written commun., 2001).

Silica.—Sand was produced by GECOPHAM for use in the construction and the manufacture of glass. A feasibility study was being carried out on the silica sand deposits at al-Qaristyn, which were estimated to have resources of 150 Mt (Industrial Minerals, 2001b). In 2000, the value of sand produced for industrial purposes amounted to $1.29 million, and for construction, $792,000 (Talal Ballaneh, General Establishment of Geology and Mineral Resources, written commun., 2001).

General Company for Glass Industry, General Syrian Glass & Porcelain Industries, and Royal Glass produced glass by using imported soda ash. In 2001, General Syrian Glass & Porcelain Industries (a subsidiary of GECI) planned to expand and modernize a glass factory, which would allow it to use the float method. In 1999, Syria produced 70,000 t of glass (Central Bank of Syria, 2001, p. 57; Middle East Economic Digest, 2001d).

Sulfur.—Syria produced sulfur as a byproduct of oil refining. GECI operated a sulfur plant in Homs with a capacity of 150 metric tons per day (British Sulphur Publishing, 1999, p. 32). Syria's consumption of sulfuric acid amounted to 318,000 t in 2000, which was a decrease from 192,000 t in 1999 and an increase from 81,000 t in 1995. About 78% of Syria's sulfuric acid was consumed in the manufacture of fertilizers.

Mineral Fuels

Natural Gas.—Syria's proven natural gas reserves were estimated to be 240.7 billion cubic meters. The Syrian Petroleum Company (SPC), which was a state-owned company, controlled 58% of the reserves; al-Furat Petroleum Company (AFPC), 18%; Mararthon Oil Corp., 13%; and TotalFinaElf, 8%. Most of Syria's natural gas was found at the al-Furat fields, Jibsah, Palmyra, and Suwaidiyah (Arab Petroleum Research Center, 2001c, p. 437, 439).

At the beginning of 2001, Syria had a production capacity of 7.5 billion cubic meters per year of natural gas. The country's gas processing plants at Jbeisseh, Omar, Palmyra, and Suwaidiyah had the ability to process 5.9 billion cubic meters per year of gas. In 2000, the value of natural gas produced in Syria amounted to $389 million; butane, $46 million; propane, $16.2 million; and pentanes, $1.23 million (Arab Petroleum Research Center, 2001c, p. 438, 440; Talal Ballaneh, General Establishment of Geology and Mineral Resources, written commun., 2001).

In September 2001, the Deir ez-Zor gas project was completed. A new gas treatment plant in Deir ez-Zor with a capacity of about 1.66 billion cubic meters per year started production; this plant was established to process associated gas from the Deir ez-Zor oilfields and nonassociated gas from the newly developed Tabiyeh gasfield. A 250-km pipeline connects the processing plant to population centers in western Syria. Conoco Inc. agreed to operate the plant for the first 4 years, after which SPC would take over operations (Arab Petroleum Research Center, 2001c, p. 438-439).

In addition to the 8 million cubic meters per day of new capacity from the Tabiyeh gasfield, six other gasfields near Palmyra were under development in 2001. The al-Abbas, al-Rasem, al-Sharif, Kom Abu Arabat, Rasif, and Zamlakh gasfields were estimated to have a combined production potential of 5.65 million cubic meters per day; production was expected to start in 2002 (Arab Petroleum Research Center, 2001c, p. 438-439).

Petroleum.—In 2000, Syria produced about 200 Mbbl of crude petroleum, of which 52% was exported; production has been declining since 1995. The value of crude petroleum produced in Syria amounted to $8.09 billion (Talal Ballaneh, General Establishment of Geology and Mineral Resources, written commun., 2001). In spite of recent declines in output, AFPC accounted for more than 60% of Syria's total crude petroleum production. The company's largest oilfields, which were located mostly in the Deir ez-Zor region, were al-Izba, al-Thayyem, al-Ward, Jarnof/Saban, Maleh/Azraq, Omar, Omar North, Sijan, and Tanak. AFPC was upgrading two of its crude-petroleum-gathering centers to increase effective production capacity by 35,000 bbl/d (Arab Petroleum Research Center, 2001c, p. 432).

SPC produced heavy crude from the northern fields in the Suwaidiyah-Karatchok area and at Jbeisseh; the company accounted for about 26% of Syria's production in 2000. The Deir ez-Zor Petroleum Company, which was a joint venture between SPC and TotalFinaElf, produced light crude and accounted for nearly 10% of crude petroleum production (Arab Petroleum Research Center, 2001c, p. 432).

Syria's petroleum products refining capacity amounted to 242,140 bbl/d; refineries located at Banias and Homs were operated by separate state-owned companies. The Government planned to upgrade the Banias and the Homs refineries and to build a third refinery with a capacity of 140,000 bbl/d.

Digitized by Google

The Governments of Iraq and Syria agreed to build a new 1.4-million-barrel-per-day oil pipeline to replace the existing pipeline that connects the two countries. Syria pledged to put its pipeline under the control of the United Nations to maintain compliance with international sanctions against Iraq (Iran Daily, 2001; Oil & Gas Journal, 2001). In July 2001, the Government invited international oil companies to bid for oil and gas exploration licenses in blocks II, IV, X, XII, and XIX (Middle East Economic Digest, 2001c).

Infrastructure

In 2000, Syria generated 23,946 GWh of electricity, which was an increase from 15,549 GWh in 1995 (Central Bank of Syria, 2001, p. 57). In recent years, the Public Establishment of Electricity Generation & Distribution (PEEGD) converted three oil-fired powerplants with a total capacity of 1,370 MW to dual oil-gas operations. About 25% of Syria's electricity was generated from natural gas.

In 2001, total installed Syrian electric-generating capacity amounted to 5,400 MW, of which 900 MW was hydroelectric. The effective operating capacity of the hydroelectric plants was about 200 MW owing to technical problems and low water levels in Lake Assad. A new 630-MW hydroelectric plant at Manbij was expected to be completed in 2001. Syria's known exploitable potential hydroelectric energy is 4,500 MW (World Resources Institute and others, 1996, p. 289; Arab Petroleum Research Center, 2001c, p. 441-442).

Outlook

The rapid expansion of the construction sector in the near future was expected to increase Syria's demand for cement to 11.5 Mt/yr in 2005 from more than 6 Mt/yr in 2001 (Middle East Online, 2001§). Higher demand for cement could lead to greater production of cement raw materials, such as gymsum and limestone. The consumption of other building materials, such as gravel, sand, and steel, was also likely to increase.

Syria's sulfuric acid consumption was mostly for the production of fertilizers; growth would be likely to follow the trend of phosphate fertilizer production. See the section on Jordan for a discussion of the world market outlook for phosphate fertilizers.

From 1995 to 2000, Syria's per capita consumption of natural gas increased by 49%, and petroleum products, by nearly 10%. The consumption of natural gas was likely to continue to grow more quickly than that of petroleum products. Electricity demand was expected to increase by 7% per year until 2010, and Syria's known oil reserves were insufficient to sustain such rapid increases. PEEGD planned to increase reliance on natural gas for future electricity needs (Arab Petroleum Research Center, 2001c, p. 441-442).

References Cited

Arab Petroleum Research Center, 2001a, Jordan, *in* Arab oil & gas directory: Paris, France, Arab Petroleum Research Center, p. 190-204.

Arab Petroleum Research Center, 2001b, Lebanon, *in* Arab oil & gas directory: Paris, France, Arab Petroleum Research Center, p. 237-246.

Arab Petroleum Research Center, 2001c, Syria, *in* Arab oil & gas directory: Paris, France, Arab Petroleum Research Center, p. 425-446.

British Sulphur Publishing, 1999, Sulphur yearbook 1999: London, United Kingdom, British Sulphur Publishing, 196 p.

Burstow, Clive, 2001, Supply side holds key to Mg: Metal Bulletin, no. 8549, February 12, p. 11.

Central Bank of Jordan, 2002, Monthly statistical bulletin: Amman, Jordan, Central Bank of Jordan, v. 53, no. 5, May, 166 p.

Central Bank of Syria, 2001, Quarterly Bulletin: Damascus, Syria, Central Bank of Syria, v. 39, no. 1-2, 80 p.

Dougherty, Pam, 2001, An uphill struggle: Middle East Economic Digest, v. 46, no. 23, June 8, p. 24-29.

Fertilizer International, 2001, Commercial phosphate rock from Syria: Fertilizer International, no. 383, July/August, p. 43-47.

Food and Agricultural Organization of the United Nations, 2001, Current world fertilizer trend and outlook to 2005/2006: Rome, Italy, Food and Agricultural Organization of the United Nations, 14 p.

Goussous, R., 2001, Stock reports—Jordan Phosphates Mines Company—2nd update: Amman, Jordan, Jordan Export & Finance Bank, 10 p.

Industrial Minerals, 2001a, Company news—...and pulls out of Jordan phosacid project: Industrial Minerals, no. 401, February, p. 72.

Industrial Minerals, 2001b, Syria—Syria opens door to mining investment: Industrial Minerals, no. 402, March, p. 15.

International Cement Review, 2001a, Jordan, *in* The global cement report: Dorking, United Kingdom, Tradeship Publications, Ltd., p. 181-182

International Cement Review, 2001b, Lebanon, *in* The global cement report: Dorking, United Kingdom, Tradeship Publications, Ltd., p. 189-190.

International Cement Review, 2001c, Syria, *in* The global cement report: Dorking, United Kingdom, Tradeship Publications, Ltd., p. 282-283.

International Iron and Steel Institute, 2001, Steel statistical yearbook 2001: Brussels, Belgium, International Iron and Steel Institute, 109 p.

International Monetary Fund, 2002, World economic outlook—Recoveries and recessions: Washington, DC, International Monetary Fund, April, 225 p.

Iran Daily, 2001, UN to control Syrian pipe: Iran Daily, February 28, p. 5.

Jasinski, S.M., 2002, Phosphate rock, *in* Metals and minerals: U.S. Geological Survey Minerals Yearbook 2002, v. I, p. 58.1-58.13.

Kendall, Tom, 2000, Fertilisers bear fruit—IM projects in Jordan and Saudi Arabia: Industrial Minerals, no. 398, November, p. 49-53.

Lidstone, Digby, 2002, Egypt/Jordan gas pipeline—Spreading the net: Middle East Economic Digest, v. 46, no. 11, March 15, p. 36.

Metal Bulletin, 2001, Syria moves to expand its steel industry: Metal Bulletin, no. 8584, June 18, p. 27.

Metal Bulletin, 2002, Bubble bursts for Jordan's mills: Metal Bulletin, no. 8648, February 11, p. 20.

Middle East Economic Digest, 2001a, EdL recruits outside: Middle East Economic Digest, v. 45, no. 46, November 16, p. 18.

Middle East Economic Digest, 2001b, Oil & gas—News in brief—Lebanon: Middle East Economic Digest, v. 45, no. 36, September 7, p. 9.

Middle East Economic Digest, 2001c, Oil & gas—News in brief—Syria: Middle East Economic Digest, v. 45, no. 28, July 13, p. 10.

Middle East Economic Digest, 2001d, Tenders—Syria—Glass factory expansion: Middle East Economic Digest, v. 45, no. 46, November 16, p. 31.

Oil & Gas Journal, 2001, Quick takes: Oil & Gas Journal, v. 99, no. 6, p. 8-9.

Scott, Neil, 2001, Jordan, *in* Mining annual review 2001: London, United Kingdom, Mining Journal Ltd. CD-ROM.

Twidale, Susanna, 2001, Overcapacity in magnesium market is set to continue: Metal Bulletin, no. 8577, May 24, p. 8.

World Resources Institute, United Nations Environment Program, United Nations Development Program, and World Bank, 1996, World resources 1996-97: Oxford, United Kingdom, Oxford University Press, 365 p.

Internet References Cited

Arab Potash Company, 2001 (May 23), Jordan Bromine Company breaks ground on bromine and derivatives facilities, accessed May 9, 2002, at URL http://www.arabpotash.com/arabpotash/bromine.htm.

International Monetary Fund, 2002a, Selected world aggregates, World Economic Outlook Database, accessed April 23, 2002, at URL http://www.imf.org/external/pubs/ft/weo/2002/01/data/w1.csv.

Digitized by Google

International Monetary Fund, 2002b, Shares of aggregate GDP based on purchasing power parity (PPP) valuation of country GDP— Developing countries, World Economic Outlook Database, accessed April 23, 2002, at URL http://www.imf.org/external/pubs/ft/weo/2002/01/data/ppp_a.csv.
International Monetary Fund, 2002c, Shares of aggregate GDP based on purchasing power parity (PPP) valuation of country GDP—Developing countries, World Economic Outlook Database, accessed June 10, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/01/data.
Middle East Online, 2001 (July 22), Syria plans increase in cement production to match building needs, accessed April 23, 2001, at URL http://www.middle-eastonline.com/English/Business/JUL2001/Syria%20plans%20increase%20in%20cement%20production%20to%20match%20building%20needs.htm.

TABLE 1
JORDAN, LEBANON, AND SYRIA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherside specified)

Country and commodity		1997	1998	1999	2000	2001 e/
JORDAN						
Cement, hydraulic	thousand tons	3,251	2,650	2,687	2,640	3,159 3/
Clay:						
Common clay		843,986	590,897	450,178	199,468	206,000
Kaolin		57,255	78,000	34,040	36,795	38,000
Zeolite tuff		NA	NA	13,086	9,797	10,100
Feldspar		--	4,008	1,000	11,112	11,500
Gypsum		193,527	175,807	244,920	157,868	163,000
Lime		4,263	4,064	4,120 e/	4,050 e/	4,100
Natural gas, gross	million cubic meters	291	264	282	287	290
Petroleum:						
Crude	42-gallon barrels	14,680	14,543 r/	14,600 r/ e/	14,600 r/ e/	14,600 3/
Refinery products:						
Liquefied petroleum gas	thousand 42-gallon barrels	1,542	1,660	1,505	1,684	1,750
Gasoline	do.	4,469	5,429	4,685	4,957	5,160
Jet fuel	do.	253	245	1,722	1,950	2,030
Kerosene	do.	1,507	1,517	1,382	1,991	2,070
Distillate fuel oil	do.	6,920	6,882	8,222	10,001	10,400
Residual fuel oil	do.	7,326	7,105	--	--	--
Asphalt	do.	866	783	830	688	690
Total	do.	22,883	23,621	18,346	21,271	22,100
Phosphate:						
Mine output:						
Gross weight	thousand tons	5,896	5,925	6,014	5,526 r/	5,843 3/
P_2O_5 content	do.	1,946	1,955	1,924	1,824 r/	1,928 3/
P_2O_5 equivalent:						
Phosphatic fertilizers		576,142	579,835	613,821	409,149	443,000
Phosphoric acid		37,761	68,345	372,169	178,701	149,000
Potash:						
Crude salts	thousand tons	1,416	1,527	1,800	1,936	1,963 3/
K_2O equivalent	do.	850	916	1,080	1,160	1,180
Salt		157,830	263,314	279,135	311,189	321,000
Sand, silica	cubic meters	NA	NA	52,224	47,218	49,000
Steel:						
Steel, crude e/		30,000 r/	30,000 r/	30,000 r/	30,000 r/	30,000
Steel, semimanufactured		350,000	325,000	300,000	270,000	331,000
Stone:						
Dimension, worked	thousand meters	6,308	6,205	6,303	3,508	3,250
Gravel and crushed rock	thousand cubic meters	NA	NA	12,180	10,381	9,620
Limestone	do.	12,388	8,031	8,000	8,000	7,410
Marble	cubic meters	57,550	134,670	10,250	21,575	20,000
Sulfuric acid:						
Gross weight	thousand tons	1,170	1,680	1,804	1,761	1,460
S content	do.	382	549	590	576	477
LEBANON						
Cement, hydraulic	thousand tons	2,703	3,316 r/	2,714 r/	2,808 r/	2,700
Gypsum e/		1,530	1,870	1,540 r/	1,600 r/	1,530
Iron and steel, metal, semimanufactures		90,000 r/	70,000 r/	55,000 r/	80,000	80,000
Lime e/		11,400	14,000	13,500	13,500	13,500
P_2O_5 equivalent:						
Phosphatic fertilizers		115,000	70,000	30,000	15,000	15,000
Phosphoric acid		90,000	90,000	100,000	122,000	122,000

See footnotes at end of table.

Digitized by Google

TABLE 1--Continued
JORDAN, LEBANON, AND SYRIA: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherside specified)

Country and commodity		1997	1998	1999	2000	2001 e/
LEBANON--Continued						
Salt e/		3,500	3,500	3,500	3,500	3,500
Sulfuric acid:						
Gross weight		174,000	262,000	249,000	357,000	357,000
S content		56,900	85,600	81,400	117,000	117,000
SYRIA						
Cement, hydraulic	thousand tons	4,840	4,607	4,781	4,830 e/	4,840
Gas, natural:						
Gross	million cubic meters	5,100 r/ e/	6,600 r/ e/	6,947 r/	6,934 r/	7,000
Dry	do.	2,700 r/ e/	3,500 r/ e/	3,676 r/	3,886 r/	3,900
Gypsum		330,000 r/	325,000 r/	394,000 r/	333,000 r/	345,000
Natural gas liquids:						
Propane	thousand 42-gallon barrels	515 e/	570 e/	500	511	510
Butane	do.	1,690 e/	1,880 e/	1,630	1,666	1,670
Pentanes	do.	45 e/	50 e/	43	44	40
Total	do.	4,015 r/ e/	4,070 r/ e/	4,000 r/	4,011 r/	4,010
Nitrogen:						
N content of ammonia		83,700	129,200	111,800	91,100	138,400 3/
N content of urea		54,400	79,600	73,400	56,600	97,700 3/
Petroleum:						
Crude	thousand 42-gallon barrels	208,700 r/	208,467 r/	210,000 r/	199,843 r/	194,000
Refinery products:						
Liquefied petroleum gas	do.	2,170	2,215	1,571 r/	1,633 r/	1,630
Gasoline	do.	11,400	11,785	10,076 r/	8,678 r/	8,680
Naphtha	do.	1,700	1,710	3,156 r/	4,419 r/	4,420
Jet fuel	do.	1,725	2,029	2,218 r/	1,457 r/	1,460
Kerosene	do.	1,500	1,546	742 r/	742 r/	750
Distillate fuel oil	do.	30,600	30,772	31,704 r/	33,176 r/	33,200
Residual fuel oil	do.	35,000	34,978	28,201 r/	27,467 r/	27,500
Asphalt	do.	1,900	1,900	2,513 r/	2,332 r/	2,330
Other	do.	1,900	2,000	826 r/	826 r/	830
Total	do.	87,895	88,935	81,007 r/	80,730 r/	80,800
Phosphate rock:						
Mine output:						
Gross weight	thousand tons	2,392	2,496	2,084	2,166	2,043 3/
P_2O_5 content	do.	730	765	635	646 r/	613 3/
P_2O_5 equivalent:						
Phosphatic fertilizers		84,200	96,500	66,100	112,700	113,000
Phosphoric acid		65,200	75,400	52,800	88,800	89,000
Salt		119,000	178,000 r/	104,335 r/	106,130 r/	106,000
Steel:						
Crude e/		70,000	70,000	70,000	70,000	70,000
Semimanufactured		95,000	80,000	85,000	60,000	60,000
Stone, sand and gravel:						
Dimension stone	thousand tons	140 e/	155 e/	154	140	150
Dolomite, refractory grade	do.	5,280 e/	2,860 e/	2,856	4,912	5,000
Gravel and crushed rock	do.	5,750 e/	6,550 e/	6,546	5,549	6,000
Sand, construction	thousand cubic meters	490 e/	560 e/	556	395	450
Sand, industrial	thousand tons	765 e/	870 e/	869	813	840
Volcanic tuff	do.	NA	NA	510	507	550
Sulfur						
Byproduct of petroleum and natural gas		10,000 r/ e/	10,000 r/ e/	11,730 r/	16,660 r/	17,000
Sulfuric acid:						
Gross weight		214,000	256,000	193,000	318,000	320,000
S content		70,000	83,700	63,100	104,000	104,600

e/ Estimated. r/ Revised. NA not available. -- Zero.
1/ Table includes data available through April 29, 2002.
2/ Estimated data are rounded to no more than three significant digits; may not add to totals shown.
3/ Reported figure.

Digitized by Google

TABLE 2
JORDAN, LEBANON, AND SYRIA: STRUCTURE OF THE MINERAL INDUSTRIES IN 2001

(Thousand metric tons unless otherwise specified)

Country and commodity	Major operating companies	Location of main facilities	Annual capacity
JORDAN			
Cement	Jordan Cement Factories Co. Ltd. (LaFarge Group, 0.44; Jordan Investment Corp., 14.3%; Social Security Corp., 9%; others, 33%)	Fuhia and Rashadia	4,500.
Do.	Arab Company for White Cement Industry	Amman	130.
Natural gas million cubic feet	National Petroleum Company (NPC) (Government, 100%)	Risha	16,400.
Petroleum:			
Crude thousand barrels	NPC	Hamza	NA.
Refined do.	Jordan Petroleum Refining Company	Zarqa	33,000.
Phosphate: 1/			
Phospahte rock	Jordan Phosphate Mines Co. (JPMC) (Jordan Investment Corp., 41.5%; Social Security Corp., 27.8%; Kuwait Investment Corp., 15.9%; others, 14.8%)	al-Hasa	4,000.
Do.	do.	Shidiya	3,264.
Do.	do.	al-Abiad	3,000.
Phosphatic fertilizers	Jordan Fertilizer Industry Company (JFIC) (Government, 26%; JPMC, 25%; others, 49%)	Aqaba	750 DAP.
Do.	Indo-Jordan Chemicals Company (IJC) (Southern Petrochemical Industries Corp., 52.2%; JPMC, 34.8%; Arab Investment Co., 13%)	Shiyada	300 DAP and NPK.
Phosphoric acid	Nippon Jordan Fertilizer Company	Aqaba	430.
Do.	IJC	Shiyada	225.
Potash	Arab Potash Company (APC) (Government of Jordan, 52.9%; Arab Mining Co., 20.7%; Islamic Development Bank, 5.2%; other, 22.8%)	al-Safi	2,000.
Salt	Jordan Safi Salt Company (subsidiary of APC)	do.	1,232.
Do.	al-Azraq	Azraq	NA.
Steel 2/	Jordan Steel plc	Amman	250.
Do.	Arab Iron & Steel Industries Company		120.
Do.	General Specialized Steel Corporation		100.
Do.	Jordan Iron & Steel		100.
Do.	National Steel Industry Co.	Awajan	100.
Do.	Petra Steel Industries Company	Amman	100.
Do.	Philadelphia Industrial Group		50.
Do.	Middle East Steel Industries Co.		36.
Do.	Universal Iron & Steel Industrial		NA.
Do.	United Iron & Steel		NA.
Sulfuric acid	JFIC	Aqaba	1,640.
Do.	IJC	Shiyada	660.
LEBANON 3/			
Cement	Societe des Ciments Libanais	Chekka	2,200.
Do.	Ciementerie Nationale SAL	do.	1,600.
Do.	Ciment de Sibline	Sibline	1,200.
Phosphate fertilizers 4/	Lebanon Chemicals Company SAL	Selaata	NA.
Phosphoric acid 5/	do.	do.	NA.
Steel	Consolidated Steel Lebanon SAL	Amchit	300.
SYRIA			
Cement	Tartous Company for Cement & Building Materials [subsidiary of General Organization for Cement and Building Materials (GOCBM) (100% Government owned]	Tartous	1,800.
Do.	al-Chaba Cement & Building Materials (GOCBM, 100%)	Aleppo	920.
Do.	Arabian Cement Co. for Cement (GOCBM, 100%)	do.	850.
Do.	Adra Co. for Cement and Building (GOCBM, 100%)	Adra	850.
Do.	Syrian Co. for Manufacturing Cement (GOCBM, 100%)	Hama	430.
Do.	National Co. for Manufacturing of Cement (GOCBM, 100%)	Dummar	190.
Do.	Rastan Co. for Cement and Building Materials (GOCBM, 100%)	Rastan	120.

See footnotes at end of table.

Digitized by Google

TABLE 2--Continued
JORDAN, LEBANON, AND SYRIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2001

(Thousand metric tons unless otherwise specified)

Country and commodity	Major operating companies	Location of main facilities	Annual capacity
SYRIA--Continued			
Cement--Continued	Military Housing Cement Group (Government, 100%)	Musselemieh	NA.
Natural gas million cubic feet	al-Furat Petroleum Company (AFPC) (Syrian Petroleum Company, 50%; Deminex GmbH, 18.8%; Pecten Syria Petroleum, 15.6%; and Royal Dutch/Shell, 15.6%)	Processing plant at Omar	2,400.
Do. do.	Syrian Petroleum Company (SPC) (Government, 100%)	Processing plant at Palmyra	2,200.
Do. do.	Conoco Inc.	Processing plant at Deir ez-Zor	1,660.
Do. do.	SPC	Processing plant at Jebissa	1,060.
Do. do.	do.	Processing plant at Suwaidiyah	240.
Nitrogen:			
Ammonia and urea	General Fertilizer Company (GFC) [Subsidiary of General Establishment for Chemical Industries (GECI) (100% Government owned)]	Homs	315.
Fertilizers	GFC	do.	122.
Petroleum:			
Crude thousand barrels	AFPC	al-Thayyem	21,960.
Do. do.	do.	al-Izba	20,130.
Do. do.	do.	Omar/Omar North	16,470.
Do. do.	do.	Maleh/Azraq	12,810.
Do. do.	do.	Si'an q	12 810.
Do. do.	do.	Jarnof/Saban	10,980.
Do. do.	do.	al-Ward	9,150.
Do. do.	do.	Tanak	6,590.
Do. do.	SPC	Suwaidiyah, Jebissa, and Karatchok	51,240.
Do. do.	Deir-ez Zor Petroleum Company (SPC, 50%; TotalFinaElf, 50%)	Qahar	10,250.
Do. do.	do.	Jafra	4,760.
Do. do.	do.	al-Mazraa and Attala North	3,290.
Do. do.	al-Khabur Petroleum Co. (SPC, 50%; others, 50%)	Kishma	6,200.
Refined do.	Banias Refinery Company (Government, 100%)	Banias	49,280.
Do. do.	Homs Refinery Company (Government, 100%)	Homs	39,100.
Phosphate:			
Phosphate rock	The General Company for Phosphate and Mines (GECOPHAM) (Government, 100%)	Eastern A	1,150.
Do.	do.	Kneifis	800.
Do.	do.	Eastern B	700.
Phosphatic fertilizers	GFC	Homs	207 TSP; NA; other
Phosphoric acid 6/	do.	do.	NA.
Salt	GECOPHAM	Bawara, Jabboul, Jbisa, and Tibni	NA.
Steel 7/	General Company for Iron and Steel Products (Government, 100%)	Hama	NA.
Sulfur	GECI	Homs	55.
Sulfuric acid 8/	GFC	do.	NA.

NA Not available.

1/ Capacity of phosphate rock and diammonium phosphate (DAP) and other nitrogen, phosphorous, and potassium fertilizers (NPK) are expressed in gross weight, and phosphoric acid is expressed in P_2O_5 equivalent.

2/ Capacity of Universal Iron & Steel Industrial and United Iron & Steel were estimated to be at least 20,000 metric tons per year (t/yr) and 15,000 t/yr, respectively, on the basis of recent production data.

3/ Capacity of sulfuric acid is estimated to be at least 357,000 t/yr on the basis of recent production data.

4/ Capacity of triple superphosphate (TSP) is estimated to be at least 89,000 t/yr P_2O_5 equivalent on the basis of recent production data.

5/ Capacity of phosphoric acid is estimated to be at least 122,000 t/yr P_2O_5 equivalent on the basis of recent production data.

6/ Capacity of phosphoric acid is estimated to be at least 89,000 t/yr P_2O_5 equivalent on the basis of recent production data.

7/ Capacity of semimanufactured steel is estimated to be at least 95,000 t/yr on the basis of recent production data.

8/ Capacity of sulfuric acid is estimated to be at least 320,000 t/yr on the basis of recent production data.

Digitized by Google

THE MINERAL INDUSTRY OF

SAUDI ARABIA

By Philip M. Mobbs

As the mainstay of the crude oil price support program of the Organization of Petroleum Exporting Countries (OPEC), the Kingdom of Saudi Arabia decreased oil production by 2.95% in 2001 compared with that of 2000. Despite the production reduction, Saudi Arabia accounted for about 12% of the world's output of crude oil (BP plc, 2002a§[1]).

The Kingdom's population was estimated to be about 23 million. In 2001, the estimated gross domestic product (GDP) at current prices published by the Saudi Arabian Monetary Agency (2002§) was $186 billion[2] compared with a revised estimate of $189 billion in 2000. Real GDP increased by 1.2% from 2000 to 2001 compared with a 4.9% increase from 1999 to 2000 (International Monetary Fund, 2002§). Production of crude oil and natural gas was valued at $64 billion, which was down from a revised $69 billion in 2000. In 2001, crude oil and natural gas production accounted for about 34% of the GDP; petroleum refining, about 3%; and other mineral production, about 0.4% (Saudi Arabian Monetary Agency, 2002§).

In 2001, exports of crude oil and products from Saudi Arabia to the United States were reported to be about 1.66 million barrels per day (Mbbl/d) compared with 1.57 Mbbl/d in 2000. Saudi Arabia, which was the second leading source of total U.S. crude oil and petroleum product imports, accounted for about 14% of imports in 2001 compared with 17% in 2000. Canada was the leading source of U.S. crude oil and petroleum products imports in 2001 with an average of 1.83 Mbbl/d (15.4% of the total import volume), Venezuela was third largest supplier with 1.55 Mbbl/d, and Mexico was the fourth largest suppluer with 1.44 Mbbl/d (U.S. Energy Information Administration, 2002).

Production

Mineral and mineral-based commodity production in Saudi Arabia included barite; cement, other industrial minerals, and construction materials; copper; nitrogenous and phosphatic fertilizers; gold; natural gas; oil; petrochemicals; refined petroleum products; salt; silver; sulfur; and zinc. Steel was produced from scrap and imported iron ore pellets.

In 2001, the crude oil production decline was partially offset by a 2.59% increase in natural gas liquids production for a 2.44% decline in combined crude oil and natural gas liquids production. The drop in oil production was attributed to a reduction in the OPEC production quota assigned to Saudi Arabia. The OPEC constrained allowable production to 7.1 Mbbl/d at yearend from 8.7 Mbbl/d at the beginning of the year (Arab Petroleum Research Center, 2002, p. 364). Actual sustainable production capacity was about 10.5 Mbbl/d (U.S. Energy Information Administration, 2001). Saudi Arabian Oil Co. (Saudi Aramco) was expected to continue to shut in less profitable heavy-crude fields as new fields with lighter premium crudes were developed.

Structure of the Mineral Industry

All minerals and mineral fuels were owned by the Government. State-owned Saudi Arabian Mining Co. (Ma'aden) participated in and promoted mineral exploration and mining activities throughout the Kingdom. In 2001, Saudi Aramco and its subsidiaries were the only companies authorized to engage in oil and gas exploration and field development within Saudi Arabia, although many industrial projects in the petrochemical and petroleum-refining sectors were joint ventures between Saudi firms and international companies.

Affiliated companies of state-controlled Saudi Basic Industries Corp. included Saudi Iron and Steel Co. (100% equity interest), National Chemical Fertilizer Co. (71.5%), Al-Jubail Fertilizer Co. (50%), National Methanol Co. (50%), Saudi Petrochemical Co. (50%), Saudi Methanol Co. (50%), and Saudi Arabian Fertilizer Co. (42.99%).

Commodity Review

Metals

Gold.—Ma'aden's production was from the open pit Al-Amar Mine and the underground Mahd Adh Dhahab Mine. A gold mine at Al-Hajar was under construction. Saudi Company for Precious Metals (a subsidiary of Ma'aden) operated the Sukhaybirat open pit mine and continued to develop the Bulghah open pit project.

Steel.—In September, commercial production began at the 180,000-metric-ton-per-year (t/yr)-capacity large diameter pipe mill operated by National Pipe Co. (NPC), which was a privately owned Saudi Arabian-Japanese joint venture. The $50 million expansion of NPC's Dhahran works had been initiated in 1999. Much of the large (610- to 1,524-millimeter-outside-diameter) pipe production was expected to be used for natural gas pipeline projects in Saudi Arabia (Sumitomo Metal Industries, Ltd., 2001§).

Industrial Minerals

Magnesite.—In 2001, the management of Ma'aden proceeded with the proposed 20,000-t/yr Zarghat fused magnesia project. Ma'aden's joint venture with Saudi Dolomite Co. Ltd. was to develop the Zarghat magnesite deposit about 100 kilometers (km) from Al-Ghazalah. The estimated cost of

[1]References that include a section twist (§) are found in the Internet References Cited section.

[2]Where necessary, values have been converted from Saudi riyals (SRI) to U.S. dollars (US$) at the rate of SRI3.75=US$1.00.

Digitized by Google

the mine and associated facilities was about $27 million (Saudi Arabian Mining Co., 2001).

Phosphate Rock.—The probability that the Al Jalamid phosphate deposit would be developed increased when the Government authorized a feasibility study of the proposed $1.9 billion 2,400-km expansion of the national rail network. The planned expansion included a rail line to Al Jalamid (Middle East Economic Digest, 2001; Washington Post, 2001).

Sulfur.—The increase in sulfur output during 2001 was attributed to the recovery of sulfur from 44 nonassociated gas wells that Saudi Aramco's brought online to supply the Hawiyah natural gas plant.

Mineral Fuels

In June, the Government signed agreements for the Gas Initiative project with the consortium of ExxonMobil Corp. (35% interest), BP plc (25%), Royal Dutch/Shell Group (25%), and Phillips Petroleum Co. (15%) for the development of Core Venture I—the Haradh (South Ghawar area) project; with the consortium of ExxonMobil (60%), Occidental Petroleum Corp. (20%), and Marathon Oil Corp. (20%) for the development of Core Venture II—the Rabigh/Midyan (Red Sea area) project; and with the consortium of Royal Dutch/Shell (40%), Conoco Inc. (30%), and TotalFinaElf Group (30%) for the development of Core Venture III—the Kidan/Shaybah Project. Negotiations between the Government and the consortia continued through yearend.

In September, the Hawiyah natural-gas-processing plant was added to the Kingdom's master gas system. The plant had reached its 40-million-cubic-meter-per-day capacity by yearend (Saudi Arabian Oil Co., 2002, p. 12).

Reserves

The U.S. Energy Information Administration (2002§) estimated that Saudi Arabia's proven crude oil reserves were 264.2 billion barrels. This represented about 25% of the total proven world reserves compared with the underexplored Iraq (10.7% of world crude oil reserves), the United Arab Emirates (9.3%), Kuwait (9.2%), and Iran (8.5%) (BP plc, 2002b§). The bulk of the Kingdom's reserves were contained in a few fields in the northeast. These included the onshore Ghawar Field and the Safaniya Field, which was the world's largest offshore oilfield.

Most Saudi Arabian natural gas reserves were associated with the country's oilfields. The Ghawar Field accounted for about 35% of the total gas reserves, which were reported to be 6.35 trillion cubic meters (Saudi Arabian Oil Co., 2002, p. 42). In 2001, the Jufayn-1 exploration well (about 14 km east of the Ghawar Field), delineation drilling (especially the Al-Ghazal-4 well), and reservoir studies allowed Saudi Aramco to add about 156 billion cubic meters to the country's gas reserves (Saudi Arabian Oil Co., 2002, p. 10).

Outlook

Despite diversification efforts, most Saudi Arabian income remained dependent upon the international oil markets. The Kingdom's economy remained vulnerable to sudden changes in volume and pattern of worldwide trade in crude, petrochemicals, and refined petroleum.

References Cited

Arab Petroleum Research Center, 2002, Saudi Arabia, *in* Arab oil & gas directory: Paris, France, Arab Petroleum Research Center, p. 364-418.

Middle East Economic Digest, 2001, Rail project gets go-ahead: Middle East Economic Digest, v. 45, no. 40, October 5, p. 15.

Saudi Arabian Mining Co., 2001, Al-Ghazalah magnesite project: Ma'aden Newsletter, v. 1, no. 1, January-March, p. 2.

Saudi Arabian Oil Co., 2002, Saudi Aramco 2001—Facts and figures: Dhahran, Saudi Arabia, Saudi Arabian Oil Co., 42 p.

U.S. Energy Information Administration, 2001, Table 2.2—World crude oil production—1990-1999, *in* International energy annual—1999: U.S. Energy Information Administration, p. 28.

U.S. Energy Information Administration, 2002, Table 3.3—Petroleum imports from ..., *in* Monthly Energy Review August 2002: U.S. Energy Information Administration, p. 48-55.

Washington Post, 2001, Iron camel, *in* Saudi Arabia advertising supplement: Washington Post, September 21, p. 20.

Internet References Cited

BP plc, 2002a (June), Oil production—Barrels (from 1965), BP Statistical Review of World Energy, accessed July 19, 2002, via URL http://www.bp.com/centres/energy2002.

BP plc, 2002b (June), Oil—Proved reserves, BP Statistical Review of World Energy, accessed July 19, 2002, via URL http://www.bp.com/centres/energy2002.

International Monetary Fund, 2002 (September), Real gross domestic product (annual percent change), World Economic Outlook Database, accessed October 28, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/02/data/index.htm.

Saudi Arabian Monetary Agency, 2002, National account statistics—Gross domestic product—Producers' values at current prices 4, accessed October 15, 2002, via URL http://www.sama.gov.sa/english/statistic/annual.

Sumitomo Metal Industries, Ltd., 2001 (September 27), NPC, Saudi Arabia started commercial operation at new plant, accessed October 21, 2002, at URL http://www.sumitomometals.co.jp/e/news/news2001-09-27.html.

U.S. Energy Information Administration, 2002, Saudi Arabia, Country Analysis Brief, accessed October 21, 2002, at URL http://www.eia.doe.gov/emeu/cabs/saudi.html.

Major Sources of Information

Ministry of Petroleum and Mineral Resources
P.O. Box 247
Riyadh, 11191, Saudi Arabia
Telephone: +(966) 1-478-1661
Fax: +(966) 1-478-0552

Deputy Ministry for Mineral Resources
P.O. Box 345
Jeddah, 21191, Saudi Arabia
Telephone: +(966) 2-669-1216
Fax: +(966) 2-667-2265

Digitized by Google

Saudi Geological Survey
P.O. Box 54141
Jeddah, 21514, Saudi Arabia
Telephone: +(966) 2-619-5000
Fax: +(966) 2-619-6000
E-mail: sgs@sgs.org.sa

Major Publications

Arab Petroleum Research Center. Arab Oil & Gas Directory, annual.
Saudi Arabia Directorate General of Mineral Resources:
Atlas of Industrial Minerals, 1993.
Mineral Resources of Saudi Arabia, 1994.

TABLE 1
SAUDI ARABIA: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity 2/		1997	1998	1999	2000	2001 e/
METALS						
Ore, mine output:						
Gross weight e/		1,600,000	1,700,000	1,680,000	1,700,000	2,000,000
Copper content of concentrate and bullion 3/		703	782	821	900 e/	800
Gold content of concentrate and bullion 3/	kilograms	7,260	5,100	4,570	3,800 e/	5,000
Lead content of concentrate e/ 3/		50	60	50	50	60
Silver content of concentrate and bullion 3/	kilograms	17,200	13,840	10,470	9,300 e/	15,000
Zinc content of concentrate 3/		619 e/	3,550	3,161	3,000 e/	3,300
Iron and steel:						
Direct-reduced iron	thousand tons	2,110	2,268	2,343	3,090	2,880 4/
Steel, crude	do.	2,539	2,356	2,610	2,973	3,400
Ferroalloys e/		83,000	83,000	83,000	83,000	78,000
INDUSTRIAL MINERALS						
Barite e/		8,000	8,000	7,000	8,000	9,000
Cement, hydraulic	thousand tons	15,400	15,786 r/	16,313	18,107	20,608
Fertilizer, phosphatic, P2O5 content	do.	112	130	145	147 e/	150
Gypsum, crude e/		365,000	330,000	380,000 4/	400,000	450,000
Lime e/		180,000	200,000	340,000 4/	350,000	350,000
Nitrogen:						
N content of ammonia	thousand tons	1,405	1,418	1,402	1,743	1,774 4/
N content of urea	do.	930	1,024	1,002	1,214	1,260 4/
Pozzolan e/		145,000	145,000	140,000	150,000	150,000
Salt e/		140,000	140,000	200,000 4/	200,000	200,000
Sand and gravel e/	thousand tons	110,000	100,000	120,000	120,000	120,000
Scoria e/	do.	2,000	2,000	2,000 4/	2,000	2,000
Sulfur, byproduct, hydrocarbon processing		1,750,000 r/	2,050,000 r/	1,939,758	2,101,391	2,350,000
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural: 5/						
Gross	million cubic meters	81,900	83,000	89,000 e/	96,000 e/	91,500
Dry	do.	45,300	46,700	46,200 e/	58,870	54,900
Natural gas liquids: e/						
Propane	thousand 42-gallon barrels	159,000	159,000	153,000	163,000	166,000
Butane	do.	69,000	69,000	66,200	69,000	72,000
Natural gasoline and other	do.	52,000	51,000	50,000	53,000	54,000
Total	do.	280,119 4/	279,163 4/	269,134 4/	285,008 4/	292,385 4/
Petroleum:						
Crude oil	million 42-gallon barrels	2,829 r/ 4/	2,922 r/	2,651 r/	2,847 r/	2,763 4/
Refinery products:						
Liquefied petroleum gases	thousand 42-gallon barrels	14,447	11,929	12,533	9,634	10,200
Gasoline and naptha	do.	138,740	142,606	148,853	155,556	74,600
Jet fuel and kerosene	do.	60,844	53,243	60,638	66,920	17,500
Distillate fuel oil	do.	191,948	193,328	188,848	198,176	132,000
Residual fuel oil	do.	165,375	176,460	164,032	163,941	121,000
Unspecified 5/	do.	6,934	6,533	6,625	8,083	8,650
Total	do.	578,288	584,099	581,529	602,310	364,000

e/ Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. r/ Revised.
1/ Table includes data available through October 18, 2002.
2/ In addition to commodities listed, the following were produced: basalt, clays, granite, limestone, marble, methanol, and silica sand; but available information is inadequate to estimate output.
3/ The Mahd Adh Dhahab Mine produced a bulk flotation concentrate that contains copper, gold, lead, silver, and zinc and a crude bullion that contains copper, gold, and silver.
4/ Reported figure.
5/ Includes asphalt.

Digitized by Google

Digitized by Google

THE MINERAL INDUSTRY OF

TURKEY

By Philip M. Mobbs

Turkey's recent economic and financial crisis had begun in late 2000. It exploded in February 2001, a little more than a year into a 3-year program to end Turkey's three decades of double- and triple-digit inflation. The crisis included a significant devaluation of the lira and soaring interest rates. The country's nominal gross domestic product (GDP) was estimated to be about $149 billion[1] in 2001 which was a 7.4% decline in the real GDP compared with 2000 (International Monetary Fund, 2002a§[2], b§). Total mineral industry revenues (primary and secondary mineral commodity production, which included cement, glass, refined petroleum products, steel, and certain inorganic chemicals) were estimated to account for about 10% of the GDP. Turkey was one of the world's major producer of barite, boron minerals, celestite (strontium), chromite, emery, feldspar, limestone, magnesite, marble, perlite, and pumice and a significant source of processed mineral commodities which included refined borates and related chemicals, cement, ceramics, glass, and steel.

Trade

The economic crisis diminished domestic mineral demand, which increased the attractiveness of minerals and mineral product exports. Total Turkish exports were valued at $31.3 billion in 2001 compared with $27.8 billion in 2000 (State Institute of Statistics, 2002§). In 2001, exports of mineral and chemical-based commodities and products included iron and steel bars, which were valued at $866 million; mineral fuels, oils, and products, $435 million; jewelry, $427 million; steel billets, $336 million; steel pipe, $285 million; steel wire rod, $213 million; inorganic chemicals, $211 million; cold rolled flat steel, $163 million; hot-rolled flat steel, $158 million; worked marble and travertine, $158 million; steel sections and profiles, $116 million; aluminum bars and profiles, $103 million; borates and concentrates, $101 million; and copper wire, $99 million (Istanbul Mineral and Metals Exporters' Association, 2002a, p. 50; b, p. 39; c, p. 46-47).

Commodity Review

Metals

Aluminum.— In 2001, Eti Holding A.Ş. revived plans to expand the production capacity of the Seydisehir aluminum smelter to 110,000 metric tons per year (t/yr) from the existing capacity of 60,000 t/yr. The modernization had been estimated to cost about $300 million in 1997, when it was initially proposed (Mining Journal, 2001). The Kibar Group proposed to increase aluminum foil and sheet production at its Assan aluminum mill in Tuzla.

Copper.—By March, operations had resumed at Çayeli Bakir Isletmeleri A.Ş., the joint venture of Inmet Mining Corp. (49% equity interest), Eti Holdings A.Ş. (45%), and Gama Endüstri (6%). Lower copper grades and a labor strike that had begun in December 2000 resulted in a decline in copper production at the mine to 33,000 metric tons (t) in 2001 compared with 37,400 t in 2000. Production of zinc (in concentrate) declined slightly to 25,300 t in 2001 compared with 26,000 t in 2000. In December 2001, Gama agreed to sell its interest in Çayeli to Inmet. During 2002, Çayeli planned to complete a $5 million tailings pipeline, to initiate a $2.2 million upgrade in the plant's crushing and filtration capacity, and to begin a proposed doubling of the mine shaft depth (Inmet Mining Corp., 2002, p. 16-18).

Gold.—In July, Normandy Madencilik A.Ş. (a subsidiary of Normandy Mining Ltd. of Australia) began mining the Ovacık deposit near Bergama. The mill had begun treating stockpiled ore in June. In 2001, about 175,800 t of ore was treated; gold production was more than 1,500 kilograms (Normandy Mining Ltd., 2001a, b; 2002). Initial ore production was by open pit with subsequent underground operations planned.

Yeni Anadolu Mineral Madencilik San. ve Tic. Ltd. Şti. (YAMAS) (a subsidiary of Anatolia Minerals Development Ltd. of the United States) reported extensive exploration activity in Turkey, which included drilling, geophysical studies, soil sampling, and trenching. In 2001, the Rio Tinto Mining and Exploration Ltd. joint venture with Anatolia incurred exploration expenditures on the Çükürdere (also known as the Cöpler), the Kabataş, the Karagöz, the Kirlangiç, and the Üçkapili properties and other properties in the Ktabataş District.

A prefeasibility study of the Kisladag gold prospect was completed for Tüprag Metal Madencilik San. ve Tic. Sti. (a subsidiary of Eldorado Gold Corp. of Canada). Tüprag continued to drill the Kisladag and the nearby Sayacik gold prospects.

Steel.—In February, the Government approved the acquisition of Iskenderun Demir ve Çelik A.Ş. (Isdemir) by Ereğli Demir ve Çelik Fabrikalari T.A.Ş. (Erdemir); issues concerning Isdemir's debt, however, delayed the takeover. Isdemir had been operating under the control of the Government's privatization organization since 1998. Erdemir also started a $72 million, 250,000-t/yr capacity galvannealing line at its Ereğli plant in 2001 (Metal Bulletin, 2001a). In November, the 2.2-million-metric-ton-per-year (Mt/yr)-capacity

[1]Where necessary, values have been converted from Turkish lira to U.S. dollars at the average rate of TL1,240,942=US$1.00 for 2001 and TL624,754=US$1.00 for 2000.

[2]References that include a section twist (§) are found in the Internet References Cited section.

Digitized by Google

Çukurova Çelik Endüstri A.Ş. steel facility in Aliağa was sold to Ege Çelik (Metal Bulletin, 2001b).

Industrial Minerals

Boron.—Eti Bor A.Ş. proposed to build a $30 million 160,000 t/yr borax pentahydrate plant to supplement output from the plants at Bandirma and Kirka. Eti Bor also proposed to build an $80 million 100,000 t/yr boric acid facility at Emet and to expand the Bandirma boric acid facility to 60,000 t/yr from 45,000 t/yr (Industrial Minerals, 2001; Eti Holding A.Ş., 2002§).

Sulfur.—Eti Holding issued a $76 million contract for the construction of a new 240,000-t/yr sulfuric acid plant at Bandirma. Operations to begin in 2003 with output from the pyrite-burning plant were to be used in the production of boric acid (SNC-Lavalin Group Inc., 2001; Eti Holding A.Ş., 2002§).

Zeolites.—Clinoptilolite was the predominant zeolite mineral produced in Turkey, especially in the Gördes area, which is located about 130 km northeast of Manisa. Turkish zeolite mining or marketing companies included Agricola Metals Corp., Enli Mining Co., and Rota A.Ş. In 2001, Eti Holding revived plans for a synthetic zeolite plant at the Seydisehir aluminum facility, which had been proposed in 1996. Eti Zeolit A.Ş. (a subsidiary of Eti Holding) proposed to produce 50,000 t/yr of Zeolite 4A for the domestic detergent market (Eti Holding A.Ş., 2002§).

Mineral Fuels

In 2001, Turkey imported about 90% of its crude oil demand compared with 89% in 2000. In 2001, 31 exploration and appraisal wells were drilled in Turkey. Most of Turkey's oil exploration and production were in the southeastern region. Crude oil production by the state-owned Türkiye Petrolleri A.O. (TPAO), which was the country's largest oil producer, continued to decline. In 2001, TPAO's domestic production was down to about 12.3 million barrels (Mbbl) from 13.6 Mbbl in 2000 (Turkish Petroleum Corp., 2002§).

By 2004, TPAO proposed to build the country's first natural gas storage facility at Silivri in western Turkey. A second storage facility was proposed for Tuz Golu in central Turkey. In May, the Government promulgated the Natural Gas Market Law, which deregulated the natural gas market and eliminated the monopoly on natural gas imports formerly held by Boru Hatlari ile Petrol Tasimaciligi A.Ş. (the state pipeline company).

The Government's oil refining company Türkiye Petrol Rafinerileri A.Ş. proposed $800 million of improvements to its refineries, which included diesel/kerosene hydroprocessing and sulfur recovery at the Izmit refinery and diesel desulfurization units at the Izmir, the Izmit, and the Kirikkale refineries (Middle East Economic Digest, 2001).

References Cited

Industrial Minerals, 2001, Eti Bor boric acid expansion: Industrial Minerals, no. 408, September, p. 15.

Inmet Mining Corp., 2002, Annual report—2001: Toronto, Ontario, Canada, Inmet Mining Corp., 56 p.

Istanbul Mineral and Metals Exporters' Association, 2002a, Istanbul demir ve demir dişı metaller ihracatçıları birliği—2001 Yili çalışma raporu: Istanbul, Turkey, Istanbul Mineral and Metals Exporters' Association, 84 p.

Istanbul Mineral and Metals Exporters' Association, 2002b, Istanbul kimyevi maddeler be mamulleri ihracatçıları birliği—2001 Yili çalışma raporu: Istanbul, Turkey, Istanbul Mineral and Metals Exporters' Association, 78 p.

Istanbul Mineral and Metals Exporters' Association, 2002c, Istanbul maden ihracatçıları birliği—2001 Yili çalışma raporu: Istanbul, Turkey, Istanbul Mineral and Metals Exporters' Association, 106 p.

Metal Bulletin, 2001a, Erdemir start up 250,000 tpy galvannealing line: Metal Bulletin, no. 8608, September 17, p. 21.

Metal Bulletin, 2001b, Turkey's largest mini-mill restarts under new ownership: Metal Bulletin, no. 8636, December 24, p. 14.

Middle East Economic Digest, 2001, Bids in for refinery upgrade: Middle East Economic Digest, v. 45, no. 16, April 20, p. 10.

Mining Journal, 2001, Turkish aluminium smelter expands: Mining Journal, v. 337, no. 8618, August 24, p. 147.

Normandy Mining Ltd., 2001a, Annual shareholder report—2001: Adelaide, Australia, Normandy Mining Ltd. annual report, 72 p.

Normandy Mining Ltd., 2001b, Report on activities to shareholders—Three months to 30 September 2001: Adelaide, Australia, Normandy Mining Ltd., October 25, 8 p.

Normandy Mining Ltd., 2002, Report on activities to shareholders—Three months to 31 December 2001: Adelaide, Australia, Normandy Mining Ltd., January 17, 8 p.

SNC-Lavalin Group Inc., 2001, SNC-Lavalin obtains a $120 million contract in Turkey: Montreal, Quebec, Canada, SNC-Lavalin Group Inc. press release, May 17, 1 p.

Internet References Cited

Eti Holding A.Ş., 2002, Investments, Annual Report 2001, accessed December 14, 2002, at URL http://www.etiholding.gov.tr/turkce/FaaliyetRapor2001/investments.htm.

International Monetary Fund, 2002a (September), Gross domestic product—Current prices—All countries, accessed October 28, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/02/data/index.htm.

International Monetary Fund, 2002b (September), Real gross domestic product—Annual percent change—All countries, accessed October 28, 2002, via URL http://www.imf.org/external/pubs/ft/weo/2002/ 02/data/index.htm.

State Institute of Statistics, 2002 (November), Table 1—Foreign trade by months and years, Provisional Foreign Trade Figures of September 2002, accessed December 8, 2002, at URL http://www.die.gov.tr/ENGLISH/SONIST/DISTICIST/27110201.gif.

Turkish Petroleum Corp., 2002, Petroleum activities in Turkey, accessed December 14, 2001, at URL http://www.tpao.gov.tr/rpte/activities.htm.

Major Sources of Information

Turkish Ministry of Energy and Natural Resources
(T.C. Enerji ve Tabii Kaynaklar Bakanliği)
Ionönü Bulvari, No. 27 Bahçelievler
Ankara, Turkey
Telephone: +(90) (312) 212-69-15
Fax: +(90) (312) 286-47-69
Internet: http://www.enerji.gov.tr

General Directorate of Petroleum Works
(T.C. Petrol İşleri Genel Müdürlüğü)
Ziya Gölkalp Cad. No. 41 Poyraz Han
06420 Yenişehir
Ankara, Turkey
Telephone: +(90) (312) 435-51-45
Fax: +(90) (312) 435-23-64
Internet: http://www.pigm.gov.tr

Digitized by Google

Istanbul Mineral and Metals Exporters' Association
(Istanbul Maden ve Metaller İhracatçıları Birliği)
Diş Ticaret Kompleksi A-bloc Çobançeşme Mevkii
Sanayi Cad. Yenibosna-Bahçelievler
Istanbul, Turkey
Telephone: +(90) (212) 454-00-00
Fax: +(90) (212) 454-00-01
Internet: http://www.immib.org.tr

General Directorate of Mineral Research and Exploration
(Maden Tetkik ve Arama Genel Müdürlüğü) (MTA)
06520 Ankara, Turkey
Telephone: +(90) (312) 287-34-30
Fax: +(90) (312) 287-91-88
Internet: http://www.mta.gov.tr

State Institute of Statistics
(T.C. Başbakanlık Devlet İstatistik Enstitüsü)
06100 Necatibey Cad. 114
Ankara, Turkey
Telephone: +(90) (312) 425-8442
Fax: +(90) (312) 417-0432

TABLE 1
TURKEY: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000	2001 e/
METALS						
Aluminum:						
Bauxite 3/		369,482	458,028	207,743	458,537	242,000
Alumina, gross weight:		164,333	156,825	159,122	155,448	100,000
Metal, smelter e/		62,019 4/	62,000	62,000	61,000 r/	61,000
Antimony: e/						
Ore, mine output:						
Gross weight		585 4/	500	3,400	6,800	7,000
Sb content		31 4/	30	180	360	370
Concentrates:						
Gross weight		500 4/	100	500	1,000	1,000
Sb content		125 4/	20	100	200	200
Cadmium		89	69	64	--	--
Chromite, gross weight (34% to 43% chromic oxide) 5/		1,702,623	1,404,470	770,352	545,725	389,759 4/
Copper:						
Mine output (exclusive of pyrite): 6/						
Gross weight		3,797,874	4,052,175	4,297,170	4,473,711	3,000,000
Cu content of ore		36,460	40,000 e/	73,051	76,053	52,000
Metal:						
Smelter output (primary and secondary)		32,491	35,000 e/	19,159	954	24,000
Refined e/		111,400	91,800	78,000	78,000	78,000
Gold e/ 7/	kilograms	1,000	1,000	1,200	500	2,000
Iron and steel:						
Iron ore:						
Gross weight	thousand metric tons	5,986	5,885	4,846 r/	4,076 r/	3,932 4/
Fe content e/	do.	3,239 4/	3,200	2,300	2,450	2,400
Metal:						
Pig iron and ferroalloys:						
Ferrochromium		108,320	110,175	99,100	97,240	50,735 4/
Ferrosilicon		4,730	4,810	420	--	--
Pig iron		577,427	456,465	314,670	300,000 e/	300,000
Steel, crude including castings	thousand metric tons	13,644	13,351	14,309	14,325	14,900
Lead:						
Mine output, Pb and Pb-Zn ores:						
Gross weight		262,260	292,065	284,504	345,391	346,000
Pb content		13,113	13,500 e/	14,225	17,270	18,000
Concentrates: e/						
Gross weight		12,063 4/	12,100	11,500	13,000	13,000
Pb content		7,912 4/	7,900	7,500	8,500	8,500
Metal, refined e/		7,000	8,000	4,000	4,000	4,000

See footnotes at end of table.

Digitized by Google

TABLE 1--Continued
TURKEY: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000	2001 e/
METALS--Continued						
Manganese ore, gross weight 8/		31,160	53,283	29,000	23,300	23,000
Silver, mine output, Ag content e/ 9/	kilograms	90,200	110,000	100,000	110,000	100,000
Zinc:						
Mine output, Zn and Pb-Zn ore:						
Gross weight		79,035	45,795	4,630	861 r/	816
Zn content		11,255	6,000 e/	545	39 r/	37
Concentrates: e/						
Gross weight		7,525 4/	5,000	500	26 r/	25
Zn content		4,169 4/	3,000	300	26 r/	25
Metal, smelter, primary		37,074	35,716	33,179	--	--
INDUSTRIAL MINERALS						
Aluminum sulfate (alunite)		8,323	10,624	11,264	12,266	12,000
Barite, run of mine		226,594	160,042	150,058	120,893	100,000
Boron minerals:						
Run of mine		2,602,386	2,754,082	2,554,404	2,398,220	2,500,000
Concentrates e/		1,568,571 4/	1,650,000	1,500,000	1,450,000	1,500,000
Cement, hydraulic	thousand metric tons	36,035	38,200	34,258	35,825	35,000
Clays:						
Bentonite		521,158	565,708	899,614	636,273	600,000
Kaolin		472,646	403,733	449,954	595,415	600,000
Other e/		6,400,000	6,000,000	6,000,000	6,500,000	6,000,000
Emery		12,345	19,027	14,535	16,830	17,000
Feldspar, run of mine		1,011,542	1,089,483	1,369,655	1,147,716	1,200,000
Fluorspar		5,000 e/	5,000 e/	4,812	4,113	4,100
Glass, crude	thousand metric tons	1,369	1,410 e/	1,203	1,300 e/	1,200
Graphite, run of mine e/		15,000	15,000	15,000	15,000	15,000
Gypsum, other than that for cement		413,802	351,557	242,960	302,552	300,000
Lime 10/	thousand metric tons	1,170	1,066	975	914	1,000
Magnesite, run of mine		1,409,768	2,703,343	1,724,744	2,672,089	2,500,000
Meerschaum e/	kilograms	400 4/	400	400	500	400
Nitrogen, N content of ammonia e/		558,000	560,000	82,400	53,400	50,000
Perlite, run of mine		103,416	124,312	147,818	149,429	150,000
Pumice		681,000 11/	579,000 11/	950,189	787,081	700,000
Pyrites, cupreous, gross weight		559,500	699,408	896,519	561,565	300,000
Silica sand, gross weight	thousand metric tons	843	1,138	1,211	1,485	1,400
Sodium compounds:						
Salt, NaCl, all types	do.	2,344	2,170	2,146	2,126	2,100
Soda ash (trona) e/	do.	500 4/	500	500	500	500
Sodium sulfate, concentrates		300,000 e/	300,000 e/	438,069	456,590	450,000
Stone:						
Dolomite		689,989	829,775	921,105	957,182	950,000
Limestone, other than for cement	thousand metric tons	49,108	52,355	28,045	30,295	30,000
Marble	cubic meters	433,517	633,432	739,240	647,160	650,000
Quartzite		1,878,339	2,301,270	2,514,383	2,743,271	2,500,000
Strontium minerals, celestite: e/						
Run of mine		50,000	50,000	40,000	40,000	40,000
Concentrates		30,000	30,000	25,000	25,000	25,000
Sulfur: e/						
S content of pyrites		63,000	--	45,000 r/ 4/	26,000 r/ 4/	30,000
Byproduct:						
Petroleum		46,000	54,000	47,000	43,000 r/	51,000
Other		91,000	91,000	75,000	75,000 r/	75,000
Total		200,000	145,000	167,000 r/	144,000 r/	156,000
Talc		4,000 e/	5,000 e/	48,378	54,278	50,000
MINERAL FUELS AND RELATED MATERIALS						
Asphalt, natural e/		117,310 4/	157,334 4/	150,000	150,000	150,000
Carbon black		39,061	39,971	26,379	35,144	35,000
Coal:						
Hard coal, run of mine	thousand metric tons	3,646	3,336	2,738	3,330	3,300
Lignite, run of mine	do.	56,780	66,499	66,706	61,315	60,000
Coke and semicoke	do.	2,335	2,144	2,811	2,090	2,000

See footnotes at end of table.

Digitized by Google

TABLE 1--Continued
TURKEY: PRODUCTION OF MINERAL COMMODITIES 1/ 2/

(Metric tons unless otherwise specified)

Commodity		1997	1998	1999	2000	2001 e/
MINERAL FUELS AND RELATED MATERIALS--Continued						
Gas:						
Natural, marketed	thousand cubic meters	250,804	561,995	718,806	611,822	600,000
Coal, manufactured e/	do.	35,000	15,000	--	-- 4/	--
Petroleum:						
Crude	thousand 42-gallon barrels	24,696	23,072	21,157	19,783	18,370 4/
Refinery products:						
Liquefied petroleum gas	do.	8,418	8,774	8,071	7,409	8,000
Gasoline	do.	33,067	31,673	38,096	39,889	25,000
Naphtha	do.	13,644	15,917	16,106	15,717	17,000
Jet fuel	do.	13,445	13,767	11,883	11,009	9,500
Kerosene	do.	578	583	730	638	200
Distillate fuel oil 12/	do.	55,248	59,860	69,551	70,333	55,000
Lubricants	do.	4,177	4,714	4,501	4,322	3,900
Residual fuel oil	do.	48,012	44,818	9,512	8,769	48,000
Asphalt	do.	8,029	10,912	7,635	7,764	6,700
Unspecified 13/	do.	33	26	1,644	3,110	18,000
Total	do.	184,651	191,044	167,729	168,960	191,000

e/ Estimated. r/ Revised. -- Zero.

1/ Table includes data available through December 21, 2002. Large quantities of construction materials (clay, sand, and gravel) are quarried. Also mined are basalt, diabase, granite, onyx, sandstone, serpentine, slate, and travertine for building stone, limestone and gypsum for cement manufacture, and zeolite, but information is inadequate to estimate output.

2/ Estimated data are rounded to no more than three significant digits; may not add to totals shown.

3/ Data are for public sector only. Data for private sector production are not available, but production is believed to be approximately 30,000 metric tons per year.

4/ Reported figure.

5/ Approximately 70% of gross production is salable product. Previously reported estimates of salable product in metric tons: 1996--900,000; 1997--1,300,000; and 1998--1,000,000.

6/ Copper mines produce a copper concentrate (of about 22% Cu) and a cupreous pyrite concentrate (about 0.7% Cu). Copper is not recovered from the cupreous pyrite concentrate.

7/ Data includes estimated content of Turkish copper refinery tankhouse slimes. Prior to 2001, all gold production was the byproduct of base metals refining.

8/ Does not include manganiferous iron ore from the Deveci Mine, production of which amounts to several hundred thousand tons per year and has a manganese content of 3% to 5%.

9/ Includes estimated content of base metals refinery tankhouse slimes.

10/ Data are lime produced for steel production and do not include the widespread artisanal production of lime for whitewash and sanitation purposes.

11/ Turkish pumice production was officially reported in cubic meters and has a density reported to range from 0.5 to 1.0 metric ton per cubic meter. Values in this table have been converted by using 1 cubic meter = 0.75 metric ton.

12/ Diesel fuel (gasoil) and special heating oil.

13/ Includes refinery fuel and losses.

☆ U.S. GOVERNMENT PRINTING OFFICE: 2004 — 673-053 / 30123 REGION NO. 8

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

UNIVERSITY OF MINNESOTA
3 1951 D02 460 091 I

Digitized by Google